

COAL AGE

NOVEMBER, 1959

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PRICE \$1

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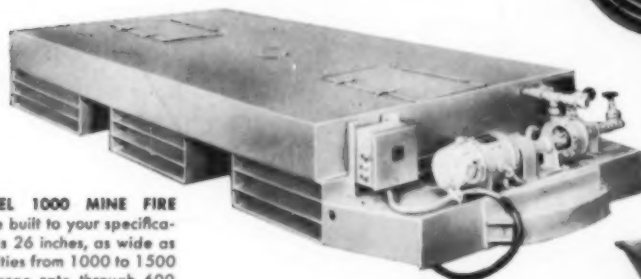
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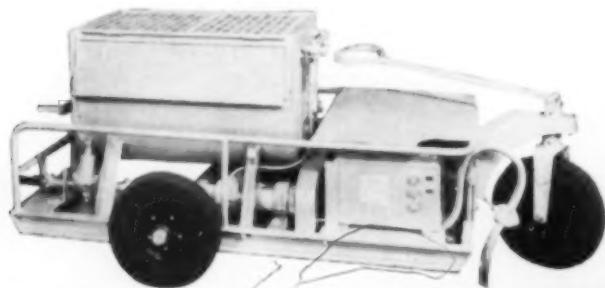
THESE MSA PRODUCTS HELP YOU FIGHT MINE FIRES INSTANTLY



M-S-A MINE FIRE HOSE is especially designed for rugged mine use. It's impervious to rot and vermin. Never needs drying. Lightweight. Easy to handle. Dated and branded for your protection.



M-S-A MODEL 1000 MINE FIRE TRUCK can be built to your specifications: as low as 26 inches, as wide as 7 feet. Capacities from 1000 to 1500 gallons. Discharge rate through 600 feet of M-S-A Mine Fire Hose is 50 gallons per minute at 50 psi.



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M-S-A MODEL 2100 MINE FIRE TRUCK has 2100-gallon capacity. Discharge rate through 600 ft. of M-S-A Mine Fire Hose is 91 gallons per minute at 150 psi. Tank is fully baffled with triple weld construction. Truck is designed for easy maneuverability.

Any delay in fighting a fire may prove disastrous. Often, the sealing of an entire mine or section results. Such an operation is not only hazardous. It's costly.

This threat to human lives and vital mining equipment, however, can be greatly reduced. You can do it with one or more of the indispensable items described above.

A minimum investment in MSA fire-fighting equipment now, may save you thousands of dollars later. Write us for helpful literature.



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MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED

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Coal travels nonstop on rubber turnpike

B.F. Goodrich improvements in rubber brought extra savings

COAL used to be hauled by trucks from a Kentucky mine to river barges. But trucks couldn't deliver it fast enough, were sometimes slowed down or stopped completely by bad weather. Engineers knew conveyor belts would be faster, would keep the coal flowing at a steady rate. But they wanted to be sure there'd be no costly shutdowns for repairs.

B.F. Goodrich was asked to work on the problem. The type of belt recommended was one B.F. Goodrich had specially developed for jobs like this.

It can carry loads long distances (the belt shown here is nearly a mile long) because of special reinforcing fabric that's stronger than fabric used in ordinary conveyor belts. It's a more flexible belt, can carry coal at high speed without spilling part of it along the way.

The belts were installed, and after more than a year hadn't caused a minute of downtime. One big reason is that this conveyor uses the B.F. Goodrich "turnover" system. The belt turns upside down after dumping the coal, then turns over again before

picking up another load. This way the coal-carrying side of the belt never touches the rollers, so there's no chance of anything sticking to the metal parts or to the belt, and causing wear.

Today, these B.F. Goodrich belts are delivering 800 tons of coal an hour, loading barges *three times faster*.

Your B.F. Goodrich distributor has full information on the conveyor belt described here. And, as a factory-trained specialist in rubber products, he can answer your questions about the many rubber products B.F. Goodrich makes for industry. *B.F. Goodrich Industrial Products Co., Dept. M-731, Akron 18, Ohio.*

B.F. Goodrich *industrial rubber products*



Flexibility, toughness and resistance to abrasion, oils, acids, alkalis and mine water are designed and built into these Tiger Brand Cables.

Keeps machines on the job. Tiger Brand cables take constant dragging over mine floors and around sharp corners. ►



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- Mold-Cured Portable Cord
- Shovel & Dredge Cable
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- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical wire and cable ?

Even though electrical cables may look alike and start with some of the same materials, there's a *real difference* in the completed cables.

The difference in USS Tiger Brand Amerclad Cables results from a combination of research, engineering and construction. The development of better materials goes on constantly at American Steel & Wire. Insulation and jacketing compounds have been improved.

Better stranding designs and methods of stranding add years to cable life.

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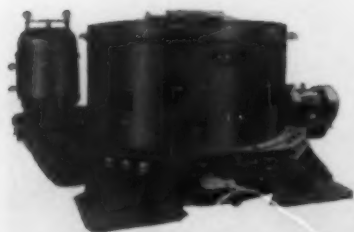
**American Steel & Wire
Division of
United States Steel**

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Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad



✓	BIRD-HUMBOLDT		
	Centrifugal COAL DRYER	Centrifugal COAL DRYER "A"	Centrifugal COAL DRYER "B"
Power	¼ HP per ton	1 HP per ton	1.25 HP per ton
Average screen life	2000-3500 hrs.	36-72 hrs.	48-120 hrs.
Recovery over screen life	98% + (almost no degradation)	85%	85%
Recommended top size of feed	1¼"	¾"	¾"
Average surface moisture on ¼" x 0 coal	5.5-7.5%	5-7%	5-7%
Method of coal discharge	By basket oscillation	By scrapers	By scrapers

CHECK THIS COMPARISON CHART BEFORE YOU BUY FINE COAL DEWATERING EQUIPMENT



The Bird-Humboldt Oscillating Screen Centrifugal Coal Dryer delivers ¼" x 28 mesh coal with 5% surface moisture and almost no degradation or loss of solids, at lowest cost per ton including write-off, power and maintenance.

It delivers stoker size (1" x ¾") coal down to 2½% surface moisture or less, likewise with negligible degradation or loss. Thermal drying costs ten times as much.



For detailed specifications, layouts and cost estimates get in touch with us

BIRD-HUMBOLDT Centrifugal Coal Dryer

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This Month in

NOVEMBER 1959

COAL AGE

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► Market Research

Planning for Growth in the Industrial And Commercial Market	p 70
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W. A. Raleigh Jr., Associate Editor, *Coal Age*

Industry response to a huge market survey already started by Bituminous Coal Institute could make or break coal in the industrial and commercial market. From 45 to 90 million tons of new business might be gained if a maximum number of companies and their salesmen cooperate in completing the survey. On the other hand, indifference and resistance to the project could result in realizing the grim prospect of continued sales erosion in this market.

Featured—Rx for Growth . . . A New Sales Approach; Authorities Speak; Defining the Market.

► Underground Augering

<i>Underground Augering Today</i>	p 76
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Recovery of thin seams that could not be mined profitably otherwise and selective mining of other seams with thick partings are two important reasons why Wind Rock Coal & Coke Co., Oliver Springs, Tenn., is pioneering a new self-moving underground auger. Employing a three-man crew, management has set a production target of 100 tons per shift. When operating in clean coal, the auger takes an average of 1 hr to drill a 100-ft hole yielding 23 tons.

Highlights—Details of auger design; the auger-mining plan.

► Maintenance Ideas

<i>Preventive Maintenance: A Positive Approach</i>	p 84
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With a successful new plan, two divisions of Princess Coals, Inc. have demonstrated the value of preventive measures in maintenance of mine equipment. Results? The causes of lost man-hours, idle equipment and excessive supply costs have been removed and reduced to achieve substantial savings in over-all operating costs.

Step-by-step—How Princess Coals re-organized its maintenance system, starting with basic groundwork, into a complete unit-assembly changeout program.

<i>Better Cable Protection with Circuit Interrupters</i>	p 91
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Here's how individual cable monitors for section equipment protect trailing cables against short circuits and grounds at Eastern Coal Corp. The advantages of circuit interrupters are:

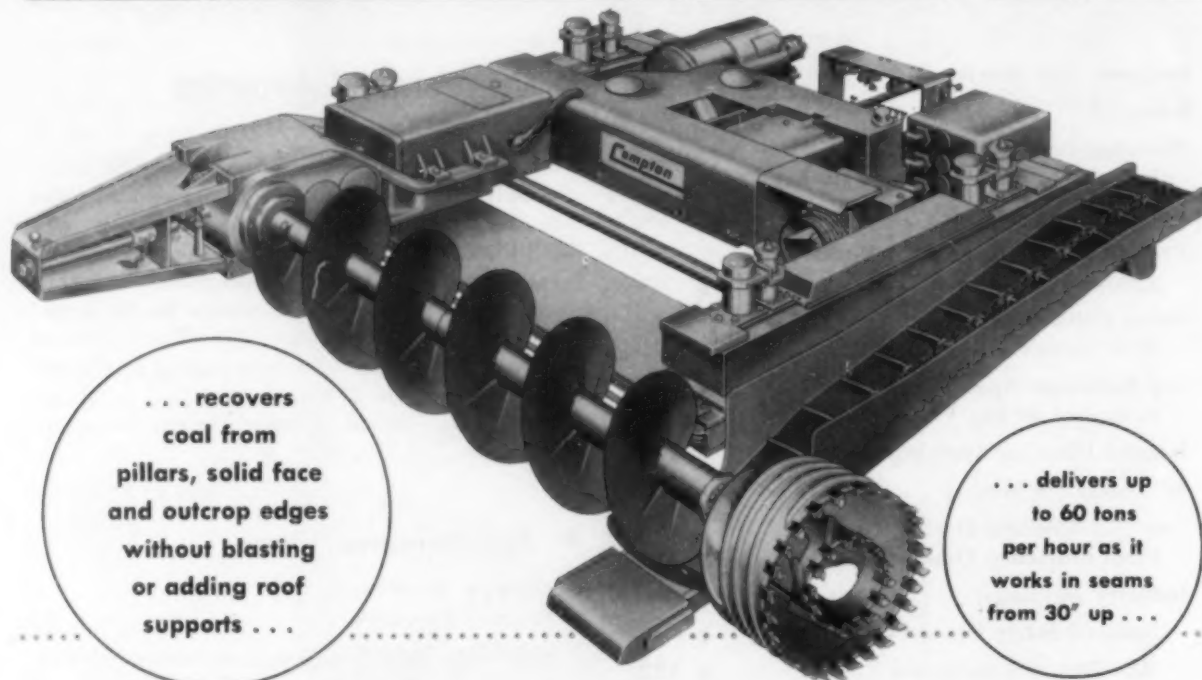
1. Longer cable life.
2. Lower cable supply cost.
3. Elimination of cable fires.
4. Less damage to short-circuited and grounded cables.
5. Greater safety for men and equipment.

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Postmaster: Please send Form 3579 to Coal Age, 33 W. 42nd St., New York 36, N. Y.

The new Model CU-32

(U. S. Bureau of Mines Approved)

Compton Underground Auger



... recovers
coal from
pillars, solid face
and outcrop edges
without blasting
or adding roof
supports ...

... delivers up
to 60 tons
per hour as it
works in seams
from 30" up ...

The new Compton Underground Auger, Model CU-32 (U.S. Bureau of Mines Approved) is a self-mobile, low-type machine that packs open pit augering flexibility deep down under.

It is designed for dual or single pillar boring; dual or single conveying and loading into shuttle cars or piggy-back conveyors ... operating "solo," or "teaming up" with a continuous miner. Pays off with superiority of performance either way ... and fast enough to pay for itself!

As a "team machine," the new Compton Underground Auger cross cuts ventilation holes, then works the coal from existing pillars, the solid face and outcrop edges without roof support and blasting, after the continuous miner moves to another section.

The Compton Underground Auger self-anchors to the roof at any height from the bottom; mobility is achieved by hydraulic

walkers or optional Cat assemblies. Optional gear trains for varied auger speeds, and optional auger handling mechanism are available.

The new Compton Underground Auger, Model CU-32 is spearheaded by its patented Cutting Head which cuts 40 to 60 tons per hour in seams from 30" up. Head, equipped with Compton Friction Bit Holders and double tapered bit shanks for fast replacement, bores 24" to 38" diameter holes through coal, binders, slate, jack rock, etc. at depths to 125 feet.

The new Compton Underground Auger is AC or DC powered. Operates effectively under normal conditions with a crew of three.

Compton, Inc.
ORIGINATOR OF COMPTON PUMP RELIABLE HEADS
CLARKSBURG, W. VA.

WHEN LOOKING FOR AUGERS—LOOK TO COMPTON

This Month in Coal Age—Cont'd

6. Elimination of fused nips.

Added Advantage—How circuit interrupters provide a better basis for a good power distribution setup.



► Stripping

Big Bulldozer Spearheads Low-Cost

Stripping at Big Valley p 96

A powerful bulldozer that cuts down 70% of the overburden sets the stripping pace at Big Valley Coal Co., Slippery Rock, Pa. The dozer has twin engines, each powering one of the crawlers through a torque converter. Crawlers have three speeds in each direction, operate independently. A 2½-yd diesel-powered shovel handles remainder of overburden which is broken by ammonium nitrate-oil mixture.

Also—Drilling and blasting methods.

► Equipment Application

Helpful Hints on Applying Pumps p 100

F. Fraser MacWilliams, Flood City Brass & Electric Co., Johnstown, Pa.

Centrifugal pumps often can be applied for duty different from that originally specified—if the fundamental laws governing pump operation are satisfied. Old pumps can be brought up to date with the addition of new bearings, and multistage pumps can sometimes be separated into simpler units for special jobs.

Helpful suggestion—How to throttle discharge, not suction, when adapting a pump to different duty.

► Electric Power

AC Cables for Coal . . .

Selection, Manufacture, Testing p 104

F. R. Hugus, Chief Electrical Engineer, Coal Machinery Div., Joy Mfg. Co., Franklin, Pa.

Part I of a two-part comprehensive survey of all cables for AC applications in coal mining features complete reference tables on cable types, constructions, capacities and resistances. Major sections are devoted

This Month in **COAL**

UNDER 400?—Final figures put the 1958 bituminous production at 410,445,547 tons. The prolonged steel strike of 1959 could well cut the 1959 total to 400 million or less—largely because of reduced consumption by steel but also because of the effects of the steel shutdown on other industries. At best bituminous can only hope that 1959 will not be too much under 1958 while looking forward to better times in 1960.

AFTER STEEL—Ore supplies for winter operation become one of the big post-settlement steel problems. Even though carriers were left at the Head of the Lakes and will operate until ice makes further trips impossible it is a question whether enough ore can be delivered to run the mills until the next season opens. And dislocations elsewhere in the economy will take their toll. Consequently, resumption of steel flow will not bring an immediate end to repercussions. The rebound, however, will be major in nature, though the time to reach normal will be extended by the necessity for getting back in the swing after the long shutdown.

HOT CARGO—The targets of the "Protective Wage Clause" included in the last bituminous wage contract seem, as a group, to be little affected. In fact, the group seems to be doing better than the unionized group, though the picture might have been a little different had "normal" market conditions prevailed. The expected contest of the coal's "hot cargo" clause in the courts may be a little closer in view of the ban of secondary boycotts incorporated in the new labor law approved in September. This provides a second possible basis of attack in addition to the antitrust argument. Even if the clause is never taken into court there is growing doubt that it can ever be really effective when conditions, as in the past few years, favor growth in nonunion tonnage.

PIPELINED COAL—The date when the next overland pipeline will be built still is up in the air pending the completion of investigations and negotiations still going on behind the scenes. But it is pretty sure that it will be built and that it will run from western Pennsylvania and northern West Virginia to the New York-Philadelphia area. And indications still are good that a natural-gas pipeliner will build and operate it since it has the know-how and right-of-way.

Question—Are there any other possibilities? Generally, any area not too far from producing fields where several million tons of power-plant or coking coal is consumed is a logical prospect. So several lines could be built in the years ahead.

HOW ACCURATE?—The steady march toward a better organizational setup for coal through association reorganization, cooperation and merger, with its emphasis on more information on marketing possibilities, is being matched by a steady increase in interest in improved statistics on distribution and use. More detail, more speed and, particularly, more accuracy, are among the goals. Substantial progress should be marked up in 1960.



**LOWEST COST PER TON WITH
McCARTHY AUGER DRILLS**

**LIVE POWER • RAPID TRAVERSE
SKIDS MOVE SIDeways, FORWARD
AND BACK • SAFETY AUGER GUIDE
EASY COUPLING PINS**

COAL RECOVERY DRILL

"Walks" from hole to hole to auger high quality coal

An Ohio miner removes 550 tons of coal in each 8-hour working day with this Model 15 36-42x12' McCarthy drill, operated by two men. He drills 42" dia. holes 144' deep. Auxiliary conveyor eliminates spillage at hole. It operates on either side of drill for working blind cut. Twelve different models of McCarthy Coal Recovery Drills mine low-cost "bonus coal".

Manufacturers of Drilling Equipment Since 1901



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VERTICAL MODEL 106-24

**World's Fastest Heavy-Duty
Vertical Auger Drill**

Bores faster, deeper, larger dia. holes than any other auger drill. New gear reduction unit slows auger rotation for operation in hard rock formations. Drills 8" and 9" dia. holes readily in shale and sandstone formations, drills larger dia. holes up to 24" dia. in softer formations.

HORIZONTAL MODEL 104

**Lowest Drilling Costs per
Foot, Self-Propelled or
Truck-Mounted**

Bores up to 12" dia. holes to 150' depth faster, cheaper than any other horizontal drill. Requires less working space, saves many man-hours... operates easily in tight, hard-to-reach locations.



FINGER-TIP CONTROL



HYDRAULIC FEED



This Month in Coal Age—Cont'd

to (1) cable selection for various applications, (2) steps in manufacture of cables and (3) methods of testing cables prior to approval.

How-To Highlight—How to calculate voltage drop from circuit diagrams.

► Coal Preparation

Low-Cost Thermal Drying, Increased Plant Efficiency, Quality Products p 118

New rotary-kiln coal dryer at Robey Run Coal Co. is designed to handle sizes up to 2 in at a rate of 150 to 180 tph. It is capable of dropping moisture from 15% to 2% and maintaining an exhaust temperature of 125 F. The dryer is completely automatic and features push-button firing of coal dust by a gas pilot light, electronic controls for increasing or decreasing heat as moisture content of coal varies and a heat-generating process that permits drying coal within 5 min after pilot light is ignited.

Plus item—Diagram of the rotary-kiln dryer.

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This Month in Mining Practice

TRENDS UNDERGROUND—Production by continuous miners was 54 million tons in 1957 when 614 machines were in service. In 1959 it should exceed 70 million. The gain will be largely at the expense of conventional loaders but these machines are not giving up too easily. As evidence, approvals were granted for 11 miners through August, 1959, against nine for loaders. Incidentally, also, shuttle-car approvals in the same period totalled 13, against nine for conveyors. However, the future will be one of accelerated growth for miners and a further increase in conveyors, though the shuttle car will give way more slowly than the loader.

TRENDS IN STRIPPING—Strip and auger production could move up again to perhaps 31% of the total bituminous output in 1959, with strip alone exceeding the 28.3% figure of 1958 by several tenths and augering gaining over its 1.8% also. This latter results from a further increase in operations going underground from the last cut.

TRENDS IN PREPARATION—A check of the contracts published by COAL AGE through October shows the conventional washer as still the most popular cleaning unit. Capacity contracted for is running about double that of heavy medium. Table popularity continues high, and interest in fine-coal treatment and water clarification is reflected in further growth in flotation units, cyclones, thickeners, filters, etc. Heat drying is distinguished by additional contracts for the fluid-bed type.

TRUCK DEVELOPMENTS—A trip through the coal fields leaves the definite impression that aluminum is moving farther and faster into the field as a truck-body material because of its weight-saving advantages. [Incidentally the number of experimental aluminum mine cars was upped recently, and the time of conclusions pro or con may not be too far off.] New developments in the platform dump which tilts the entire truck to discharge the load may encourage wider use. Rather than the original overhead hoist, or the rocker type employing coal and engine weight for dumping and return, one new model employs telescoping body hoists to tilt the platform, materially simplifying installation and operation.

COMPUTERS FOR COAL?—Though some of the class of machines known as "computers" are used in coal mining, such use has been limited by their size and cost. The computer industry, however, is bringing out new and smaller models practically every day, and freely prophesies that it will have machines to match almost every pocketbook before too long. Application? One is control of the supplies and parts inventory. Another is customer service and sales control. And so on. The saving is not necessarily in clerical or office help, but in the greater variety of information available on which to base decisions and the speed with which it is provided.



4810 AIR HOSE



Where men and hose flex their muscles

Here's the hose that's as rugged as the men who use it. On the really tough construction jobs—where tight quarters, abrasive terrain and high working pressures take their toll of ordinary air hose—mandrel-made, wrapped-finish, U.S. 4810 Air Hose stands up to use and abuse.

Yet, despite its great strength, 4810 is no muscle-bound hose. "U.S." engineering has made it easier to



handle, readily flexible, able to take higher working pressures—and *less expensive*—than the conventional air hose you might be using. It's one of a complete line of U.S. Rubber construction hose.

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.



Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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The Coal Commentator

Easy Task

Among the developments of the summer of 1959 was an announcement by the Santa Fe that it was scrapping 77 steam locomotives, the last of 2,000 once operated. Such news still generates pangs but they were considerably eased by the new generating peaks marked up by coal's No. 1 customer—the electric utilities.

These summer peaks were the direct result of the rise in use of air conditioners which, as is becoming well known, is causing utilities to search for balancing outlets for the winter months. The best bet is home heating electrically, and it is snowballing in interest. As an example, the 4th *Electrical World* Electric Comfort Heating and Heat-Pump Conference, in St. Louis, Oct. 21-22, was the biggest ever. And next year the National Electrical Manufacturers Association will sponsor, for the first time in its history, a National Electric House-Heating Exposition (Sherman Hotel, Chicago, March 21-23).

Here's one program it should be easy to get behind and push.

Safety in the 60's

The intriguing head to this little piece is the theme of the 1959 National Safety Congress, as well as the title of a 185-p book digesting the ideas of 300 top men in various industries as to what can be expected in the next decade.

The question of what will happen in coal immediately comes up. Fatality rates in bituminous and anthracite were 1.13 and 2.11 per million tons in 1949. For the first 8 mo of 1959 they were 0.63 and 2.24, with anthracite up from the preceding year's figure of 1.61 as a result of a disaster early in the year. Can coal halve its rate again in 10 yr? Falls of roof, face and ribs remain a most inviting target, with haulage in the second spot. There is no reason to feel that bearing down as necessary in these and other areas will not get results that could more than halve the rate again.

For those who might read this in 1969: Did we do what we should have done in getting injuries and fatalities down to the irreducible minimum?

Seisms in Stripping

Preparation has been favored with gamma-ray generators for process control, underground miners with sensing gadgets to keep them on course, and accounting the computer. Now stripping has been provided with a new tool—seismic analysis—to help operators determine the character of the overburden in advance.

The list of new gadgets and improvements on the old will expand as more and more work is done

to mechanize and automate coal production, with remote control of underground operations and automatic operation of surface plants almost just around the corner.

But is there anything missing in the list—any really serious problem for which an answer is not likely in the near future? One is a means of determining the condition of the roof quickly and accurately in underground mining—unless the problem is eliminated by a system of support or reinforcement that will make all roof good automatically.

Currency Coup

Do our neighbors appreciate us? That is a question that probably bothers every coal man at one time or another when something happens that leaves him feeling that the importance of all the money pumped into the local economy for manpower, materials and services is not appreciated.

Many methods of bringing this home have been tried by one company or another. Among those with the advantages of both simplicity and low cost is one recently adopted by the Hawks Nest Coal Co., of Cedaredge, Colo. It paid its men in \$2 bills, accompanying this payoff with advertising carrying the message that each such bill represented money produced by coal. As can be imagined, the effect was immediate and evident.

Thought for the day: Maybe the idea is worthy of much wider use.

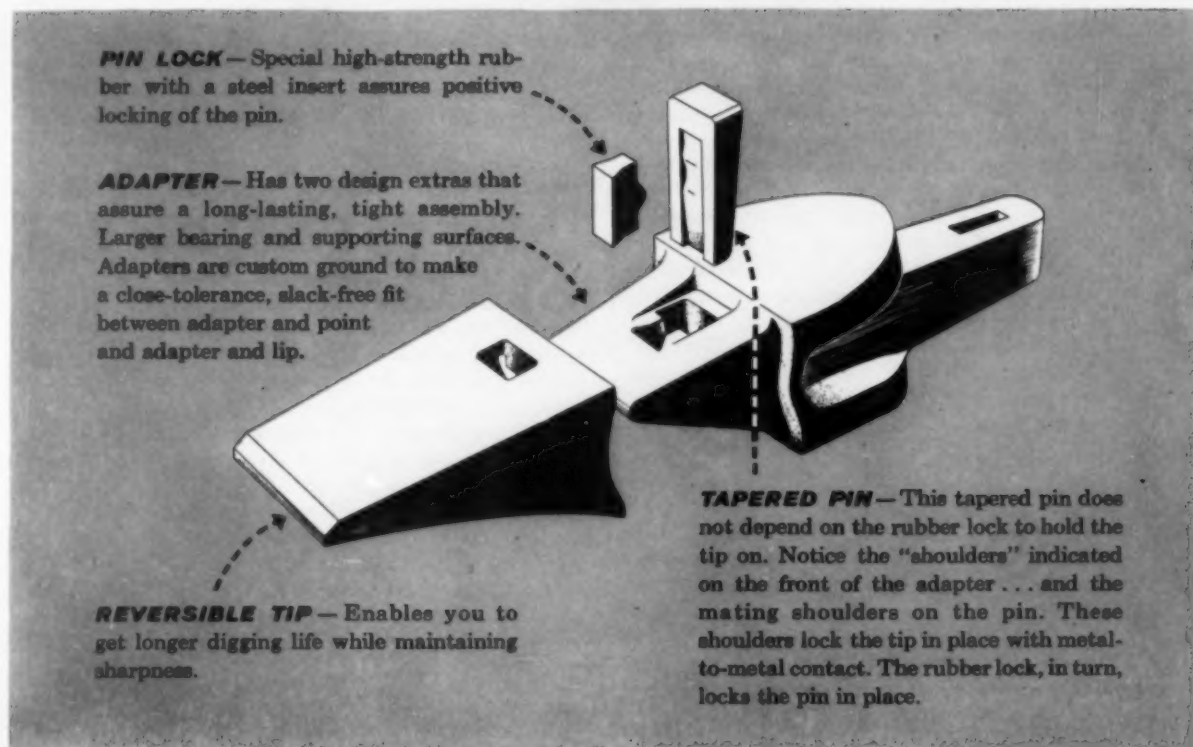
W. Va. Water

The recent report of the W. Va. State Water Commission for this fiscal year 1957-58 highlights progress in alleviating stream pollution, particularly from the solids standpoint. The report points out that "at the present stage of technology practically nothing can be done to alleviate the acid once it leaves the mine," though it notes that the commission is controlling new sources "where known and where feasible."

Where solids are concerned the report shows a great deal of progress. On June 30, 1958, of the 202 washeries in the state 109 were provided with adequate facilities for treating wastes. In 1953, only 21 out of 201 plants had adequate facilities. Judging from contracts in the past year or so, the record will be measurably better when the next report comes out.

Since the coal industry along the Ohio Valley particularly, and elsewhere as well, is likely soon to be faced with "do or else" regulations on pollution, including acid, the record of progress to date, more than being a source of gratification, should serve as a signal to step up efforts in the future. Otherwise, things could be tough.

NEW AMSCO® 2 PART TOOTH



3 big features for fewer shovel shutdowns

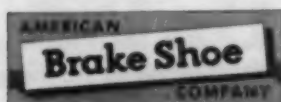
1 You get up to four times extra wear over other 2-part teeth. We cast these new teeth of a tougher, new and special heat-treated alloy that slashes your replacement and maintenance costs.

2 These reversible teeth stay sharp, to penetrate cleanly and easily without straining your shovel. Reversing point is easy. This reversible feature is particularly

important on corner teeth. It maintains digging efficiency throughout tooth life.

3 Positive locking device — Amsco's unique pin-locking design secures tip to adapter in tight, positive, metal-to-metal contact.

Order the Amsco 2-part Simplex from your local power shovel dealer.



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American Manganese Steel Division • Chicago Heights, Ill.
OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS, JOLIETTE, QUEBEC

ROBERTS & SCHAEFER uses THE INDUSTRIAL ATOM

for continuous, accurate control of density

THE EXCLUSIVE R&S HEAVY MEDIUM CYCLONE WASHER

Cleans Fine Coal Cleaner Than Any Other Cleaning System

Now...with the Heavy Medium Cyclone Washer...you can employ nuclear energy to produce fine coal that is always uniformly clean.

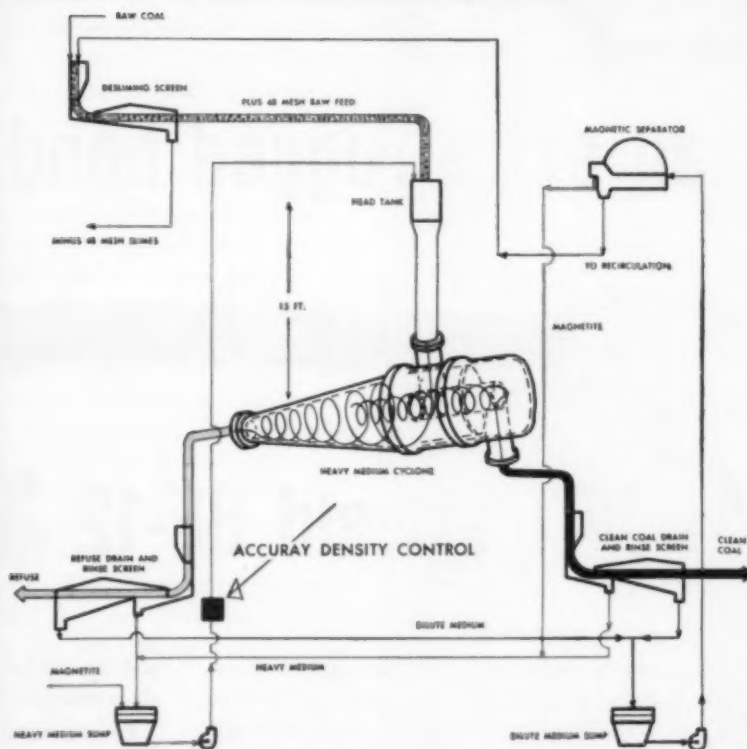
Roberts & Schaefer now uses, as optional equipment, the famed AccuRay Density Measurement System. Density of heavy medium in the cyclone is controlled by electrons with positive accuracy.

AccuRay is widely used for positive control of essential processes in the production of chemicals, plastics, rubber, tobacco, petroleum, paper and metals, as well as in heavy medium processes on coarse coal.

The Heavy Medium Cyclone Washer for fine coal is made in the United States exclusively by Roberts & Schaefer. It is the only fine coal cleaning process which uses magnetite as the medium.

Heavy Medium Cyclone Washing, with nucleonic control, can be installed in your present facilities as well as in a completely new plant. Call or write us for detailed information.

FLOW DIAGRAM OF HEAVY MEDIUM CYCLONE WASHING SYSTEM



*AccuRay™ is the registered trademark of INDUSTRIAL NUCLEONICS CORPORATION

- Delivers coal with higher Btu, lower ash.
- Maintains rigid uniformity of quality.
- Obtains maximum recovery of fine coal.
- Washes at any specific gravity you want.
- Holds magnetite consumption to a minimum.
- Operates at highest efficiency regardless of size distribution, particle shape or percentage of near gravity material.
- Produces no measurable degradation of the coal.
- Assures effective specific gravity separation independent of viscosity due to accelerated shearing forces within the cyclone.
- Operates at maximum efficiency through all ranges of capacity.

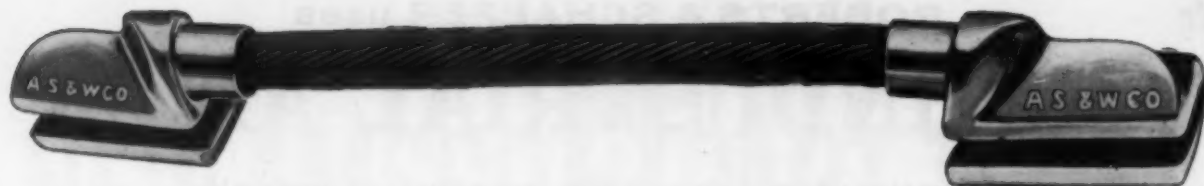


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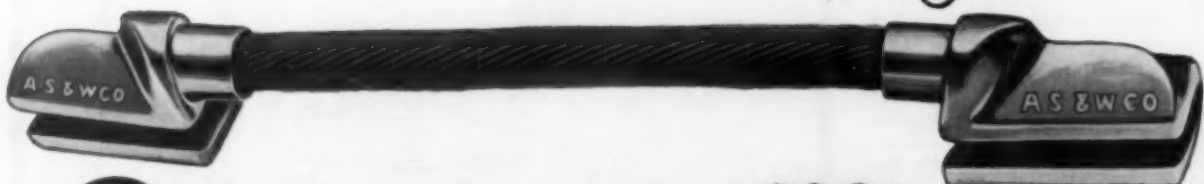
DIVISION OF THOMPSON-STARRETT COMPANY, INC.



For extra-rugged service



an extra-rugged bond



USS Tigerweld BF-12



Look at this photo and you will see why the Tigerweld BF-12 is so durable. The raised shoulders on each of the terminals form V-shaped troughs with the web of the rail. Into these troughs you can lay extra metal to guarantee a permanent weld.

The terminals and the strand are connected by the familiar Tigerweld butt-weld which makes the joint stronger than the strand itself. The heat of welding cannot harm the joint. The entire bond has the strength to stand up under heavy stresses,

USS and Tigerweld are registered trademarks

and the reinforced steel-to-steel weld of the BF-12 gives you added assurance of long bond life.

Easy to install. A couple of hammer blows on the terminals will hold it to the track while you weld. No clamps are needed. You save time . . . you save expense with installation crews.



NEW CATALOGUE. Our latest revised catalogue gives full details on all Tigerweld Power Bonds. Write today: American Steel & Wire, Rockefeller Building, Cleveland 13, Ohio.

**American Steel & Wire
Division of**



United States Steel

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Increase the life of your wheels with S-D Hard-Faced Treads and Flanges...

"Modern mass-production equipment has catapulted Sanford-Day into the position of top mine wheel 'rehabilitation center' of the country."

—Fusion Facts

Why you save on S-D Hard-Faced Wheels (New or Reclaimed)

For years wheels like the one at right had to be discarded. Its (1) Tread and (2) Flange are "worn-out". But otherwise the wheel is as sound and serviceable as a new one. We have solved the problem of



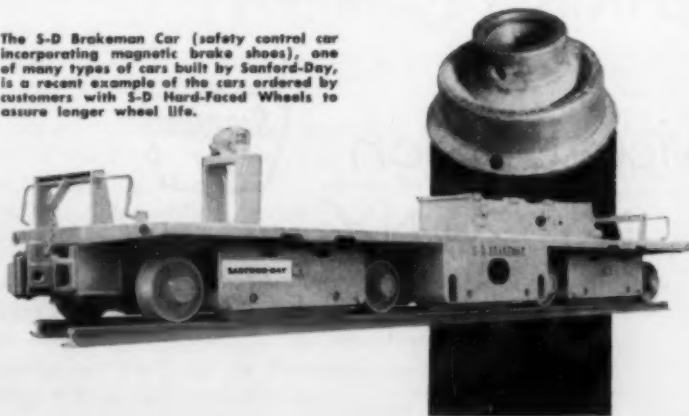
Several completely automatic fixtures, such as this one, were developed at Sanford-Day in cooperation with the welding industry to mass-produce S-D Hard-Faced new wheels and reclaim old ones. Heads are shown here depositing high alloy on treads. A different alloy is used on flanges. Secret of long wheel life is obtaining wheels furnished with wearing surface on treads to take "impact", while wearing surface on flanges will take "scrubbing". S-D Hard-Facing assures you maximum and equal service of both tread and flange!

getting wearing material on a wheel where it does some good . . . on the tread and flange where it is used! We have reclaimed thousands upon thousands of "worn" wheels by successfully applying high alloy materials to the tread and flange of discarded wheels. These reclaimed wheels have earned such favorable savings, and due to oftentimes tripling their service life, many users have been ordering new wheels S-D Hard-Faced. They save the cost and down time of changing and reclaiming wheels when ordinary wheel flange and tread wear out.

What counts is the proper alloy on the tread and flange! Over given period of time your wheel requirements will be reduced substantially when you order and use S-D Hard-Faced Wheels. Write us today for BULLETIN E-100 that furnishes complete information and specifications. Sanford-Day Iron Works, Inc., P. O. Box 1511 . . . Telephone 3-4191, Knoxville, Tennessee.

Pictured below is a test wheel after many months service in severe service. It shows no appreciable wear on the S-D Hard-Faced tread and flange.






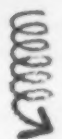


The S-D Brakeman Car (safety control car incorporating magnetic brake shoes), one of many types of cars built by Sanford-Day, is a recent example of the cars ordered by customers with S-D Hard-Faced Wheels to assure longer wheel life.



Worn wheel above shows typical condition of wheels formerly discarded. Field reports and customer experiences with S-D Hard-Faced Wheels show that reclaimed wheels, like one below, often give three times the service life of unprotected ones at far less than new part cost.



SANFORD-DAY
KNOXVILLE TENNESSEE

If it rolls on an axle  or turns in a bearing  or rides on a shaft  if it slides in a groove  or moves on a pivot  if it bores  or cuts  or transmits pressure  one of Sinclair's 500 specialized lubricants is designed to make it work better. For answers to your lubrication problems, write today to

SINCLAIR REFINING COMPANY

Technical Service Division
600 Fifth Ave., N.Y. 20 N.Y.





Why the "built-in values" of General Electric Mining Cables are so important to you

"Built-in values" make General Electric cables outstandingly successful in meeting the needs of the mining industry. These values result from designing, engineering, and building into these cables carefully developed and selected components and particular construction advantages.

Three examples of these important values are:

Two-layer reinforced lead-cured jackets. Here's how the jackets of G-E portable mining cables are made to resist abrasion, pulling, crushing, and twisting: 1) *Lead curing* gives a dense, tough jacket with added longitudinal and radial mechanical strength; 2) a strong, *twine open mesh* is built in as an integral part of the jacket to provide greater over-all tensile strength and radial strength in order to reduce displacement of the core members.

Flexible conductors that reduce breakage. Flexibility and long service life are achieved by special rope concentric stranding of conductors, developed through years of testing and field service.

Insulation with toughness and crush-resistance. Insulation for 600-volt cables, for example, is a GRS heat-resistant rubber compound with excellent electrical characteristics and the necessary mechanical toughness and resiliency for the severe conditions encountered in mining applications.

All General Electric mine cables bear the embossed symbol P-108 of the Pennsylvania Department of Mines, and where required also carry the BM marking indicating listing by the United States Bureau of Mines.

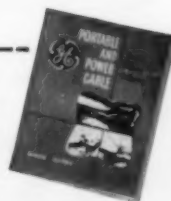
To get complete information about G-E mine cables, mail the coupon for new, up-to-date brochure.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

General Electric Company
Wire and Cable Department
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Bridgeport 2, Connecticut

Please send me your new booklet on
General Electric Portable and Power
Cables for the mining industry.



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Designed for High Production . . .

Low Maintenance

the **JOY 14BU-**

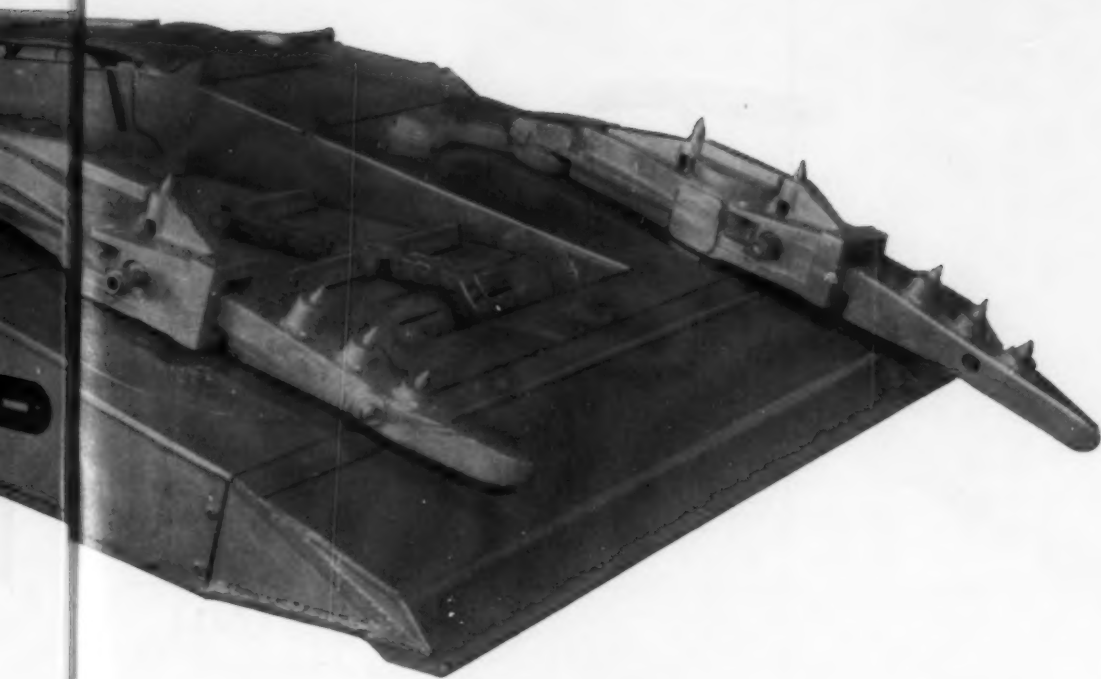
24" HIGH—LOADS 15 TONS PER MINUTE . . . the Joy 14BU-10 is only 24" high . . . yet it has the efficiency and power of a high machine. This tremendous capacity for its size is the result of a completely new design.

The 14BU-10 loads faster because the loading head is 90" wide. This means fewer passes to clean up. The conveyor is 30" wide with a pan line just 14" from the floor—the lowest in the industry. This means room to carry out large lumps in the lowest seams.

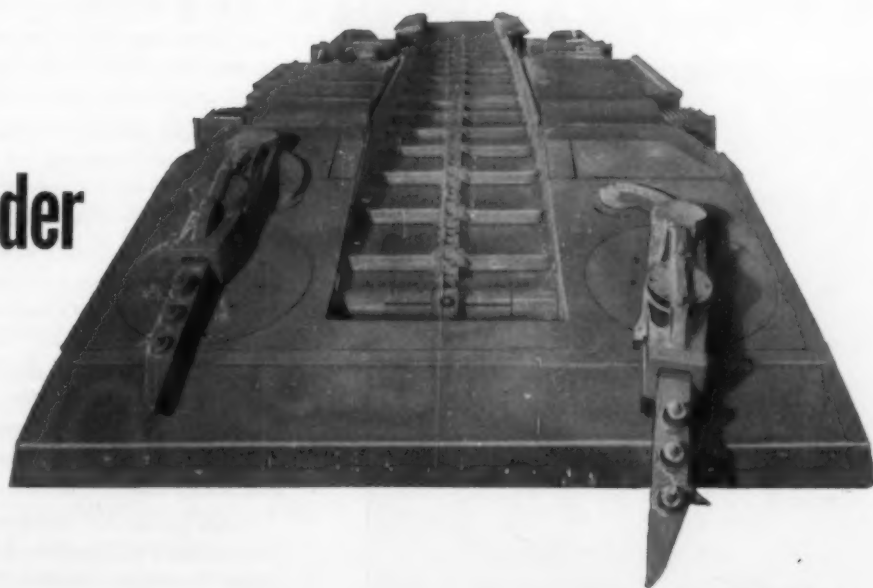
Like larger Joy loaders, the 14BU-10 is designed for low maintenance and is mechanically simple. It has no shifting clutches. All motors and parts requiring maintenance or inspection are mounted outside the frame for easy access and maintenance.

If you operate in a 28" to 34" seam, find out more about the new 14BU-10, the loader really designed for low seams. It can change your profit picture.

399-999



10 loader



**WORLD'S LARGEST MANUFACTURER OF
UNDERGROUND MINING MACHINERY**

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*America's Most
Complete Line of
Shaft Mounted
Speed Reducers*

**55
MODELS**

- Capacities up to 170 hp
- Output speeds from 10 to 378 rpm!
- Single Reduction
- Double Reduction
- 5 to 1 Ratio
- 15 to 1 Ratio
- 25 to 1 Ratio
- Any speed ratio up to 150 to 1 obtainable by selection of pre-determined combination of reducer and V-belt drive.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the white pages of your telephone directory for "Dodge Transmissioneer."



Torque-Arm

**THE DODGE DEVELOPMENT
THAT CHANGED THE
NATION'S HABITS OF
SPEED REDUCTION**

In fewer than ten years, the range of Torque-Arm Shaft Mounted Speed Reducers has increased from 6 to 55 models, to meet the ever increasing demand for this improved method of speed reduction.

By eliminating foundation, sliding base and flexible coupling this modern speed reducer has saved untold installation time and untold dollars of cost.

The rugged semisteel housing developed by Dodge has never been improved upon. It is corrosion resistant—and it has the strength to hold bearing seats in line for the life of the unit.

Dodge design provides wide spacing for the bearings. Loads are carried easily, contributing to Torque-Arm's long life and very high efficiency. The gears are finest quality—helical, heat treated steel.

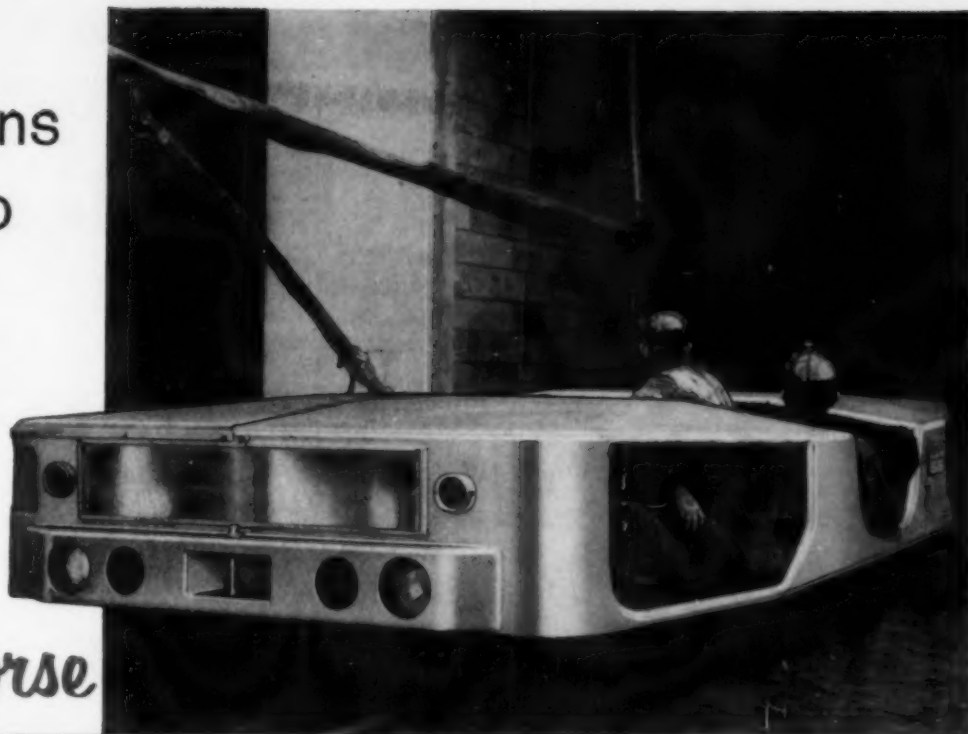
Torque-Arm mounts vertically or horizontally in any position around the driven shaft. It locks to the shaft on *both* sides of the housing. The holes in the output hub provide simple removal with puller. Overload release and built-in backstop are optional.

Dodge Torque-Arm is America's most widely used shaft mounted speed reducer. It is stocked by your local Dodge Distributor. Ask him. Or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 3000 Union, Mishawaka, Ind.

DODGE
of Mishawaka, Ind.

Reasons
why so
many
mines
use
the
Lee-Norse



LOW mine portal bus

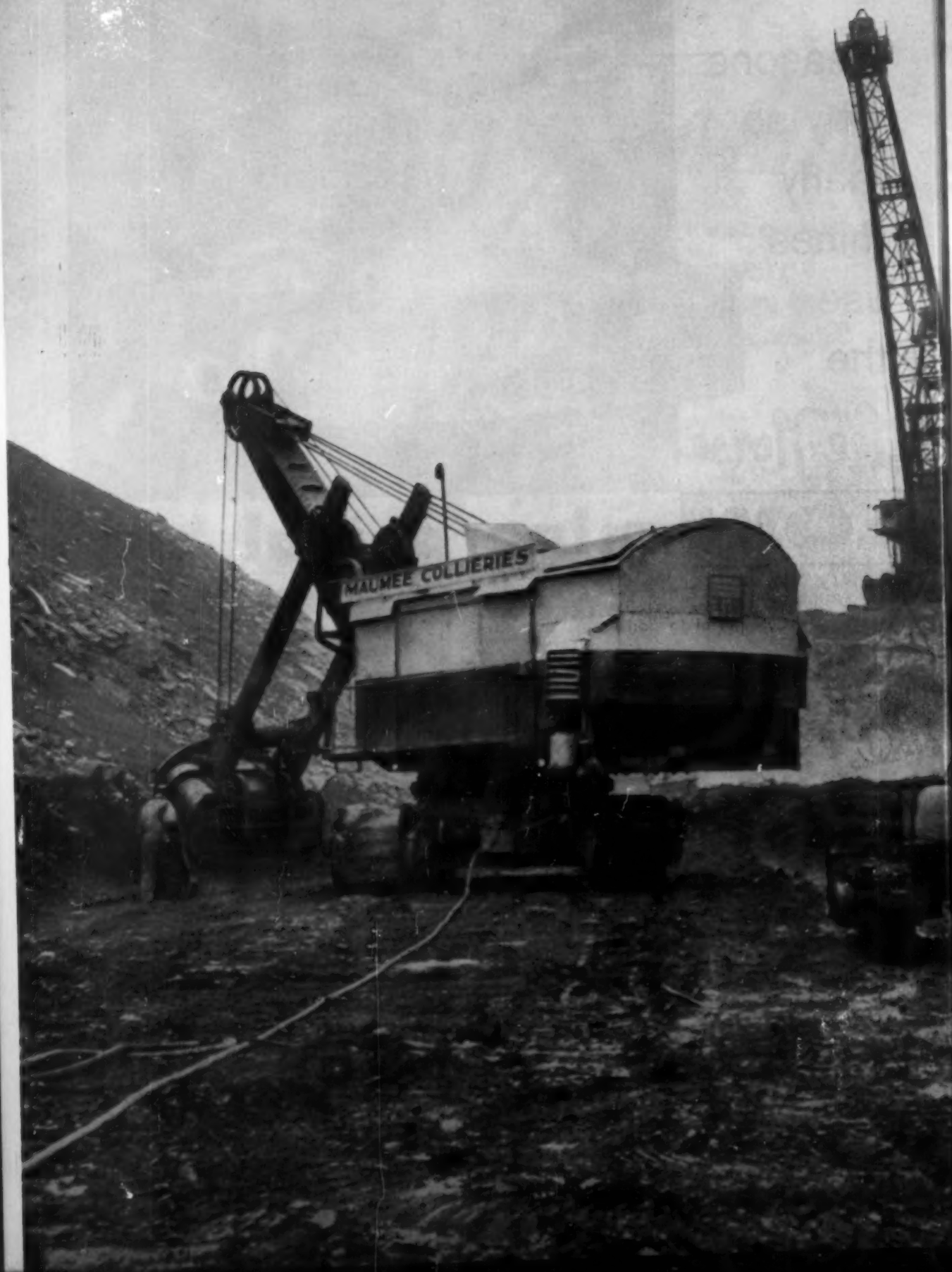
- ① **FAST**—Cuts portal to portal time as much as 50%.
- ② **STREAMLINED**—Transports 11 to 13 men in safety and comfort in low seams.
- ③ **SAFETY**—Exclusive split-roof allows operator full directional vision—trolley pole easily reached. Quick acting hydraulic truck-type brakes on each axle and on the traction gearmotor. Independent mechanical hand parking brake each axle.
- ④ **POWERFUL**—Self-propelled by sturdy traction-type 15 HP gearmotor (250 or 550V—DC).
- ⑤ **RUGGED**—Quality built to withstand the hard usage of 'round the clock mining!
- ⑥ **LOW MAINTENANCE**—Simple design—easy accessibility.
- ⑦ **OPTIONAL FEATURE**—Electric dynamic brakes for plus safety on severe grades.



Lee-Norse Company

CHARLEROI, PENNSYLVANIA

Specialists in Coal Mining Equipment





At the Maumee Collieries in Indiana...

ANACONDA SHOVEL CABLE HAS A RECORD: 10 YEARS ON THE ROCK PILE!

Anaconda's SH-D Cable gives many years of dependable service in spite of heat, moisture, kinks, rocks and runovers!

How many shovel cable hazards can you count in this picture from the Maumee Collieries? Rocks... moisture... kinks... danger of runovers—they're all there. Yet the first installation of Anaconda's rugged SH-D Shovel Cable has resisted them all—for 10 long years!

It's proof again of the way Anaconda's in-the-field experience with Shovel Cable pays off in a superior cable for you. The important knowledge gained from use and testing of SH-D Cable *on the job* in our own mines goes into the design and manufacture of Anaconda Shovel Cable.

For example, the insulation is Anaconda Butyl (AB). Nothing can beat it for withstanding ozone, heat and moisture. Patented rubber cores cushion the ground wires and help prevent breaks from kinks and runovers. SH-D has a neoprene jacket that is exceptionally tough and abrasion-resistant. And every design, every component has been job-tested—your assurance of superior quality and performance.

Call on the Man from Anaconda with your cable problems. Or see your local Anaconda distributor. For new descriptive Bulletin DM-5818, "Anaconda Security-flex Portable Cables for the Mining Industry," write: Anaconda Wire & Cable Co., 25 Broadway, New York 4, New York.

00218

◀ For a decade, the Anaconda SH-D Shovel Cable you see here has been giving dependable service for the Maumee Collieries, Jasonville, Indiana. Its many superior design features enable it to resist on-the-job hazards that would knock out ordinary shovel cables.

ASK THE MAN FROM
ANACONDA[®]
FOR SHOVEL CABLE

Power-full MICHIGAN

looks to the Central for
dependable delivery of coal



Michigan — a state of widely diversified industry — is a mighty consumer of electrical energy. Its ever-growing appetite for power is supplied, for the most part, by two companies — Detroit Edison and Consumers Power.

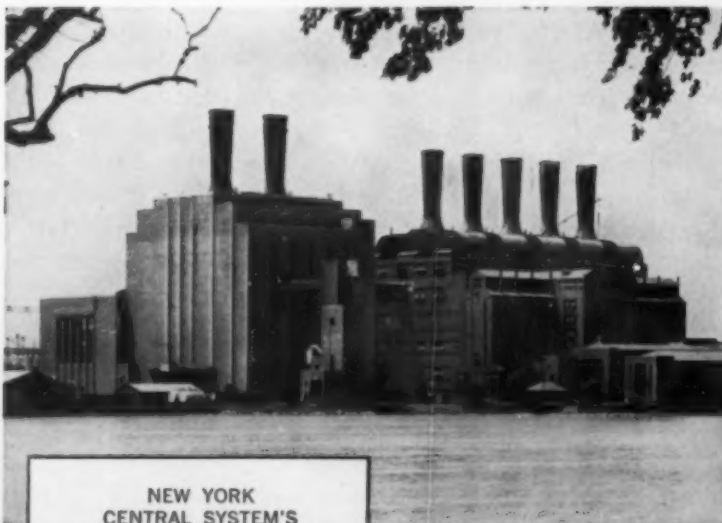
Between them, these two burn well over 8 million tons of coal a year, and both of them look to the Central for dependable deliveries in any weather.

With their huge, modern plants and efficient operation, these companies are able to offer ample

power at rates which are an important factor in attracting new industry to their state.

Throughout the territory served by the Central, coal is the most efficient and economical fuel for most purposes. To help you make the most effective use of coal, the Central's staff of technically trained fuel experts will analyze your needs and make suitable recommendations — without cost or obligation.

For assistance or information call or write your nearest New York Central Coal Sales Representative.



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CENTRAL SYSTEM'S
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Trenton Channel Plant
of Detroit Edison.



John C. Weadock Plant of
Consumers Power with the new Dan
E. Karn plant in foreground, Bay
City, Michigan.

New York Central Railroad

For loading in intermediate and high seams of coal, potash and gypsum



new Goodman 967 loader

This newest Goodman loader with 38" basic body height and a load line height of 24", is conservatively rated at 15 to 20 tons per minute. It's the answer to high capacity loading in intermediate and higher seams because of these built-in advantages:

30" Wide Conveyor with ample depth at all points to contain any surge load. A rugged 2 $\frac{1}{4}$ " pitch chain keeps material moving.

12" Wide Treads each with 4 $\frac{1}{2}$ " of ground contact plus a total weight of 14 tons provide a stability for the heaviest kind of loading. 6" roadway clearance assures freedom of movement on all types of bottom.

The above advantages are combined with these additional features . . . 7'6" clean-up width . . . 55 gathering arm strokes per minute . . . adequately

powered with 4 motors, each 21 hp. DC, 26 hp. AC . . . quick-acting hydraulic controls . . . extra strong construction throughout.

For the full story of the new 967 loader and of shuttle cars with the speed and capacity to keep it working, contact your Goodman sales engineer.

GOODMAN

MANUFACTURING COMPANY

Halsted Street and 49th Place, Chicago 9, Illinois

CUTTING MACHINES • CONVEYORS • LOADERS
SHUTTLE CARS • LOCOMOTIVES • CONTINUOUS MINERS

Use Genuine Goodman Replacement Parts

News Roundup



WATCHING movie on mining techniques (left) students participating in program planned by WAIMME, are completely engrossed. Question and answer session later in program and letters many students wrote after their trips indicated they learned a great deal about the mining field. Down in a mine (below), having been given full line of equipment, youngsters, mostly from Junior High School level, get the feel of mining.



Youth Takes a Look at Mining

Outstanding junior high school students live on university campuses, tour industrial properties and mines . . . see films and hear lectures about mining, metallurgical and petroleum engineering.

"ENGINEERS FOR TOMORROW," established by the western Pennsylvania Woman's Auxiliary to the AIMME, is an education program to expose promising young students to the fields of mining, metallurgical and petroleum engineering.

It is a result of WAIMME's determination that America will not in the future have the engineers it needs for growth and progress unless some active planning is done today. How the venture developed and its unusual success provides an interesting example for more programs of its type.

Two years ago, when WAIMME undertook a study of figures showing enrollments and graduations of engineers, it found that the studies of mining, metallurgical and petroleum engineering were receiving less applicants each year. The decline, which is continuing, is exemplified by these figures WAIMME cites from the *Journal of Engineering Education 1959 Yearbook*:

1. The 29 accredited mining schools graduated an average of 7.6 engineers in 1957-58. At this depressed state freshman enrollments in the Fall of 1958 declined another 16% below senior enrollments.

2. The 49 metallurgical colleges graduated an average of 13.7 engineers

in 1957-58 and the freshman enrollments in the Fall of 1958 declined 27% below senior enrollments.

3. The 25 petroleum schools graduated an average of 27 engineers in 1957-58 with freshman enrollments in the Fall declining 34% below senior enrollments.

Fast Action—Realizing that, as in many things, lack of interest can stem from lack of information and experience, the women's organization speedily set up a program with the cooperation of industry and universities that would permit outstanding young men to view first hand the challenges of life as an

engineer. This "Pilot Student Venture," as it was called, sent 10 boys to the University of West Virginia to live on campus for several days, attend classes and get extensive background in the whys and wherefores of mining. At one point the boys were provided with proper attire and taken on an actual tour of mines and industrial properties nearby.

Success—Responses from the students and their hosts from industry and the universities was extremely favorable and the WAIMME, thus encouraged, established "Engineers for Tomorrow," a broader and more comprehensive program. Preparing the 1959 tours, 27 women in western Pennsylvania contacted high schools and conducted interviews. Eventually 36 boys from the area were selected as well as 12 others from West Virginia where the WAIMME also conducted interviews. The organization arranged to finance the board and lodging of the students at the universities plus transportation and meals wherever this would not be provided by industry.

Educational institutions to which tours were run this year included Pennsylvania State University, Virginia Polytechnic Institute, West Virginia University and the University of Pittsburgh. A typical tour included dinners, mining movies and lectures, trips to

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The Importance of Balanced Compounding in Portable Cable Design

A portable cable is constantly under attack from many different directions. It is dragged over rough floor surfaces and rocky terrain, crushed under the wheels of trucks and carts, continually bent, flexed and stretched. In addition, it is very often subjected to attack by water, solvents, oil and ozone.

To give long, dependable service, portable cables must be able to withstand rough treatment, and must have built-in protection against all deteriorating factors. Moreover, they must possess other desirable qualities such as lightness and flexibility.

The science in designing these cables is to add the necessary ingredients in the jacket to provide maximum protection along with the maximum of other desirable features. This is where *Balanced Compounding* comes in. It is very easy to provide protection against one or two of the deteriorating factors, simply by loading the compound with an ingredient which is impervious or highly resistant to these factors. Unfortunately, however, the ingredients which provide resistance to abrasion or crushing may be highly susceptible to attack by oil or water; and vice versa.

The cable designer's problem, then, is to attain a balance in his compounding formula which will provide maximum protection against one deteriorating factor without reducing protection against others below the danger point.



To the buyer of cables, this means that *quantity* of any one ingredient is unimportant, unless it is considered in relation to the over-all ability of the cable jacket to resist *all* of the abuses to which it is subjected.

For balanced resistance to all these abuses, the best assurance you can get lies in the quality of the research and development facilities of the manufacturer, and the product's record of performance.

This is one reason why — in those

industries where portable cables are continually used or purchased as components of a manufactured product — Simplex Tirex Cables are regarded as the standard.

Proof of the worth of Tirex *Balanced Compounding*, which gives balanced resistance to all the deteriorating factors of normal use, can be found in the fact that Tirex cables have been successfully performing under the most rugged operating conditions for periods ranging up to twenty years.



Simplex

WIRE & CABLE COMPANY

Cambridge, Massachusetts and
Newington, New Hampshire

News Roundup (Continued)

mining operations and industrial plants, visits to laboratories and a closing question and answer session.

Reactions—The success of the tours can best be measured by the reactions of the students, many of whom wrote letters of appreciation and appraisal after returning home. Here are a few:

"I was never more interested in any few hours before in my life."—James Studnicki

"Before I went on this educational and interesting trip I had no idea that planning a coal mine could be such a challenge . . . I thank you not only for the wonderful trip but perhaps for deciding my career."—Paul W. Hoff

"After this informative trip I will consider an occupation in the broad field of mining."—James Miller

"Never before had I realized that there was as much to mining and the importance of mining as there is today . . ."—Jeff Nicholson.

Summing Up—The tours complete, the women do not stop there but follow-up with literature, lists of accredited schools and recommended reading which is mailed to the students at various intervals to "keep the seeds nurtured." They also acquaint the

students with scholarship awards and available loan programs.

Thus, what started as a test project has developed into an important and satisfying hobby for the WAIMME, one that will be continued in the future, contributing to the growth and prosperity of the nation. Commenting on "Engineers for Tomorrow," Dr. Howard L. Hartman, professor and head of the department of mining at Pennsylvania University, declared "it has merit and certainly warrants the country-wide participation and support of the AIMME. I hope that it becomes an annual event in the future."

Peabody Contract

The Tennessee Valley Authority has awarded Peabody Coal Co. a contract for 65 million tons of coal, worth \$191,750,000, to be delivered over a 17-yr period at a new steam-electric plant to be built by TVA at Paradise, Ky. The contract is believed to be the largest ever awarded to a single coal company.

The new plant, to cost \$100 million, will house the world's largest steam turbine generator, said a TVA spokes-

man. It will be the first such project to be financed under the public sale of revenue bonds, a method recently approved by Congress. The plant, scheduled to begin operations in September, 1962, will have a 600,000-kw capacity and will be built by General Electric Co.

Officials of the power authority said the new site was selected because of the "unusual advantages for low cost operation." Because of its proximity to coal supplies transportation costs are "virtually eliminated," TVA noted, adding that maximum trucking distance from mine to plant is 5 mi.

Deliveries by Peabody, slated to begin in August, 1962, will be 40,000 tons a week and will continue at this rate through April, 1963, when the rate will be stepped up to 80,000 tons a week.

Largest Mine—It is understood that Peabody will develop what is expected to be the world's largest strip mine with 4 million ton capacity at the site of the proposed steam-electric plant. Excavation of foundations will entail mining of coal, which reportedly will be stockpiled.

Equipment will include a 100 cu yd shovel and a 70 or 80 cu yd bucket with the longest boom ever. Trucks, now in the design stage, will exceed 100 tons



Coal Men Test First Aid Skills

THE HARMAR COAL CO. TEAM, with a standing of 99.667%, copped the field in the 1959 Pennsylvania State Bituminous Safety Association's 17th Annual First-Aid Meet held Saturday, Sept. 12, in South Park, Pittsburgh, Pa. The team, seen with the trophy, included (left to right): Front row—Ted Mackos, Walter Sonnie, George Flynn; Back row—W. M. Buzard; C. H. Callahan; and John Krasovsky. Finishing in second place in the meet was Emerald Coal & Coke Co. with a score of 99.600%. Other competing teams taking third to eighth places respectively were: Duquesne Light Co., Warwick mine; U. S. Steel Co., Robena No. 2; U. S. Steel, Robena No. 1; National Mines Co., Renton mine; Buckeye Coal Co., Nemacolin mine; and Imperial Coal Co., Diamond No. 2.

THE ITMANN TEAM from Pocahontas Fuel Co. was the winner of the first-aid contest held at Beckley, W. Va., on Aug. 22. Henry Carter of Mine Safety Appliances Co. presents (above) the first place trophy to the team including (left to right): Front row—John Salters; James Cook; and Howard Cox; Back row—Carl Parks (accepting trophy); Harold Carte; William McCoy; Ralph Green; and H. H. Moorefield. The event, sponsored by the Fayette Raleigh Wyoming First-Aid League, had 35 teams representing 10 southern West Virginia counties and one in Virginia. Second and third place went to Holden Mine No. 27 and the Wyoming mine, both of Island Creek Coal Co. Pocahontas Fuel Co.'s Bishop, Va., team took fourth place.

100 TONS PER MANSHIFT



Indeed!

It is possible... with the development of longwall
pneumatic roof control.

DOWTY... world pioneers and leaders in
hydraulic roof control... has developed the
ROOFMASTER, fully mechanical support system
for longwall mining.

With application of the ROOFMASTER, all
functions of roof control on a 600-ft. longwall face
may be performed with two men. Results: greater
production, greater profits, greater safety.

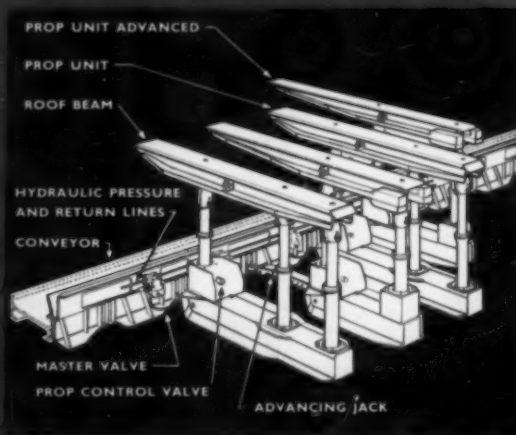
Write for detailed
literature without delay!

DOWTY

MINING LIMITED

AJAX, ONTARIO, CANADA TELEPHONE AJAX 131
DOWTY CORPORATION 10 MADISON, N.Y., U.S.A.
TELEPHONE DOWBY 4-6076

world pioneers of hydraulic roof control



The ROOFMASTER

The DOWTY Roofmaster consists of self-
advancing, hydraulic-powered support frames.
Only two men required for continuous
operation of 200 support frames. A daily
advance of 15 ft. on a 600 ft. longwall
retreating face would provide a daily
output up to 2,000 tons with a total crew
of 20 men.



HERE'S THE MONEY-SAVING, TIME-SAVING ANSWER

to METAL DETERIORATION
in COAL PREPARATION PLANTS

LINCO Regular Lining

Replacement of worn metal in coal preparation plants causes down time and costly repairs. To avoid these headaches wherever you have deterioration of metal lining due to impact, abrasion or corrosion, use the amazing, new Linco Regular Lining.

REDUCE COSTS

The Linco Regular Lining process offers you the most efficient, low cost method of protecting metal parts against abrasive wear with a high strength cementitious protective material.

High Speed INSTALLATION

Down-time waiting is minimized. Regular maintenance on metal surfaces is made without heavy welding equipment. With a notched trowel and a supply of Linco Regular Lining, reapplication of lining is simple, fast and easier. Use of Linco Regular Lining over the newly introduced RL-50 Bond gives even greater saving in time and money. (See chart below)

Comparative Lining Cost Chart†

	MATERIAL COST	LABOR COST	TOTAL COST	SAVINGS
Build two new funnels for magnetite boxes out of ½" steel	\$35.00	\$175.00	\$210.00	
Use Linco Regular Lining on worn sections of old funnels* over expanded metal	\$30.00	\$ 25.00	\$ 55.00	\$155.00
Use Linco Regular Lining over RL-50 Bond	\$26.00	\$ 5.00	\$ 31.00	\$179.00

*The old funnels lined with Linco Regular Lining will outlast the new funnels.

†Names supplied on request



GET THE FULL STORY: If you have a problem in metal deterioration . . . LINCO has a solution. You can get the advantages of the special

LINCO consultative service for industrial linings without obligation. Write today!

Linco Company
Specialists in Maintenance Problems
for Prep Plants
762 S. MAIN STREET
GREENSBURG, PA. Temple 4-1302

News Roundup (Continued)

and possibly reach 200-ton capacity, add the reports.

Coal, to be truck-loaded and hauled directly to the plant, will be mined on virgin coal lands, with operations beginning at the site and progressing outwards to a maximum distance of 5 mi. Two and in some instances, three seams of coal will be mined with total thickness of 13 and 18 ft respectively, say the reports.

Hydraulic Research

The Bureau of Mines recently began experiments in mining bituminous coal with powerful jets of water, at an old mine of the Rochester & Pittsburgh Coal Co. near Indiana, Pa.

Bureau engineers, who say that thus far tests have been "extremely encouraging," play water at pressures up to 4,000 lb per sq in against the coal face to break down the coal. A 1-in hose with a ¼-in nozzle conveys the water.

The system resembles that used for many years in hydraulic gold mining. Bureau engineers also studied the use of water jets in the commercial mining of gilsonite in Utah and analyzed technical reports from several other countries, especially Russia, where water jets are used extensively.

An immediate advantage, the Bureau points out, is the elimination of explosive coal dust. This safety measure might be coupled with increased output under certain conditions, it was added. The tests, which will continue for several months, will include studies of types of nozzles, pumping equipment and water lines, the effects of varying water pressure and the possibility of using water to convey the broken coal from the mine or to underground loading points.

UMW Welfare Fund

The annual report of the United Mine Workers of America Welfare and Retirement Fund for the year ended June 30, 1959, released recently, showed an unexpended balance of \$134,531,995 as compared with \$145,832,703 on the same date in 1958.

The report showed 208,946 beneficiaries of the Trust Fund—miners and their dependents—received \$139,877,814 in pensions, hospital and medical care and other benefits. As of June 30 there were 65,491 retired miners receiving the \$100 monthly pension, which unlike pensions in almost all other industries, is in addition to earnings or income from any other source, including Social Security benefits.

It was noted that "since the first miner's pension check was issued over a decade ago retired coal miners, who were also drawing Social Security benefits, have received an increase of approximately 111% in their Social Security checks."

John L. Lewis, president, UMW, Henry G. Schmidt, president, North American Coal Co. and Josephine Roche, a Fund director, released the report.

Buys Coal Boilers

The Baltimore & Ohio R.R. has ordered two 300-hp Coal-Pak automatic packaged boilers for its Riverside, Md., shops.

The Coal-Pak is a fully automatic coal-fired packaged boiler engineered for unit installation. Its principal features are an automatic coal feed system, a water-cooled vibrating grate, forced and induced draft fans and a screw-type ash removal conveyor. A simple and reliable control system provides the complete assembly with full automation.

The Coal-Pak was developed by Bituminous Coal Research, Inc., supported by companies interested in the mining, preparation, sale, transportation and use of bituminous coal. The B&O is one of nine railroad members.

Railroads Merge

Two of the nation's major soft coal hauling railroads, Norfolk & Western R. R. and the Virginia Ry. Co., have been granted permission by the Interstate Commerce Commission to merge.

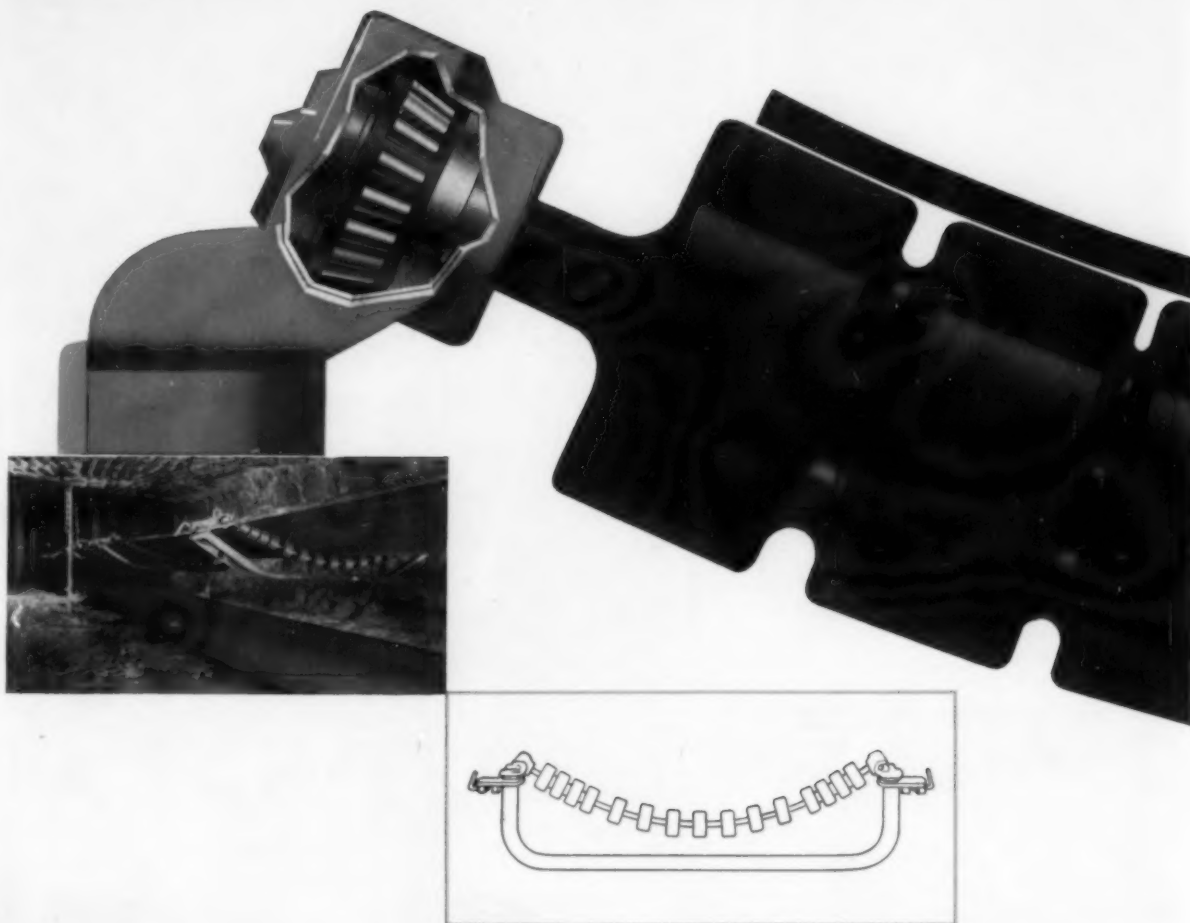
The merged line will be a 2,746-mi system running through the Pocahontas soft-coal region in Virginia and West Virginia through Norfolk, Va. In addition, it will extend westward to Cincinnati and Columbus, Ohio, and will operate branches through Hagerstown, Md., Bristol, Va., Winston-Salem, N. C. and Durham, N. C.

This is the first major railroad merger approved by the ICC in modern times, it is noted. In its report, the ICC said: "Merger of the Norfolk & Western and Virginian will plainly result in a larger, stronger company better able to meet the challenges faced by the railroad industry and better able to attract and hold competent management personnel."

The Commission said the merger will benefit the coal industry in southern West Virginia and southwest Virginia, afford improved service to shippers, make possible an intensified program for industrial promotion, extend the economic

(Continued on p 62)

Bearing Location is the Key to Long Service Life



JOY LIMBEROLLER® CONVEYOR IDLERS

Joy Limberoller Conveyor Idlers give many times the normal service life, because the two bearings rest in slots in the support brackets—well away from spillage. On underground conveyor lines, troughing is improved and belt life is increased because the Limberoller idler, mounted on wire rope stands, "gives" with the load. Limberollers have given many times the service life of steel idlers.

Limberoller Idlers consist of a neoprene coated wire rope to which are moulded neoprene discs. The ends of

the rope turn in sealed bearings. This design not only eliminates clogging and freezing of the bearings, but also makes the idlers easy to service—they can be replaced while the belt is moving.

Limberollers are economical, not only because of long service life, but also because they can be spaced further apart than steel idlers. They are corrosion and flame resistant, self-cleaning, and eliminate the "bump" typical of steel idlers.

For complete details, write for Bulletin 352-1.



**WORLD'S LARGEST MANUFACTURER OF
UNDERGROUND MINING MACHINERY**



JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company
(Canada) Limited, Galt, Ontario



TWO DRAVO-3200 "CHOTINS" JOIN RIVER SERVICE

Irene Chotin and Joey Chotin, Dravo's two newest stock 3200-hp towboats, are now in service pushing high speed petroleum tows. Both boats are designed with the Dravo Precision-Balanced Propulsion concept, and are backed with the proven performance of previous Dravo-3200's. They are 148 feet long, 34 feet wide, and 10 feet 6 inches deep. Two more stock 3200's are under construction and will be available soon. For full details on how one of these Dravo-3200 towboats can benefit you, contact Marine Department, Dravo Corporation, Pittsburgh 25, Pennsylvania.



DRAVO
CORPORATION

November, 1959 • COAL AGE

EXPANSION SHELLS and PLUGS for ROCK BOLTING

STANDARD EXPANSION SHELL AND PLUG

The O-B Standard Expansion Unit has been a "standard" of the mining industry since its introduction commercially in 1949. Its introduction was preceded by half a century of experience in supporting hangers and line materials from mine roofs, and by a long period of laboratory and underground testing. Subsequent experience has modified the unit to take advantage of later research in laboratory and mine.

The basic design of these units has now been tested and proved by more than 80,000,000 bolt installations!

Shell and plug are cast of malleable iron in the O-B foundry, where modern quality control assures a final product consistently superior in strength and resistance to impact.

Plug threads are accurately tapped to fit any commercial roof bolt, and the length of thread provided is enough to break a bolt without stripping.

Shells are cast as a single piece, with four serrated prongs or fingers. Fingers are slightly pre-expanded during factory assembly to assure a snug fit in the bolt hole even when the hole is slightly oversize.

Both shell and plug are given a factory coating of No-Ox-Id, which prevents rusting, serves as a lubricant on plug threads, and prevents seizing and galling between shell and plug.

During installation, the plug is drawn into the shell, expanding the shell fingers in four directions into the sides of the bolt hole. This four-way expansion distributes expansion forces evenly on all four shell fingers, keeps unit stresses on shell and plug low even at high tension.

(See page 2 for installation procedure; page 4 for ordering information)

BAIL-TYPE EXPANSION SHELL AND PLUG

The O-B Bail-Type Expansion Unit retains the advantages of the O-B Standard Unit and in addition, offers several other important advantages.

The shell consists of two parts, which are assembled on the plug by means of a strong, cold-finished steel bail. Interlocking lugs at the base of the shell halves assure proper alignment during installation.

This construction allows greatest flexibility between shell parts, and assures the greatest possible ease of installation in the bolt hole. The shell is always held in correct relation to the plug, and "upset ears," Palnuts, and other extra-cost methods of supporting the shell are eliminated.

Both shells and plugs are cast of the same high quality malleable iron as the O-B Standard Units.

Both shell and plug are factory-coated with No-Ox-Id, which prevents rust, lubricates plug threads, and reduces friction between shell and plug during installation.

Expansion pressures are distributed evenly on all four shell fingers, resulting in low unit stresses on plug and shell even at high tension.

(See page 2 for installation procedure; page 4 for ordering information)

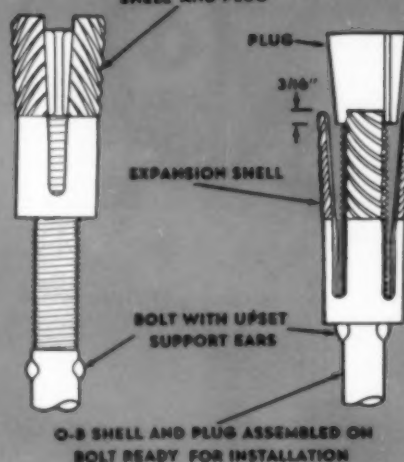
O-B EXPANSION SHELLS AND
PLUGS HAVE BEEN TESTED
AND PROVED BY MORE THAN
80,000,000 BOLT INSTALLATIONS



Ohio Brass®
EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY
AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS
HOLAN

OHIO BRASS COMPANY • MANSFIELD, OHIO

FACTORY PRE-ASSEMBLED O-B EXPANSION SHELL AND PLUG



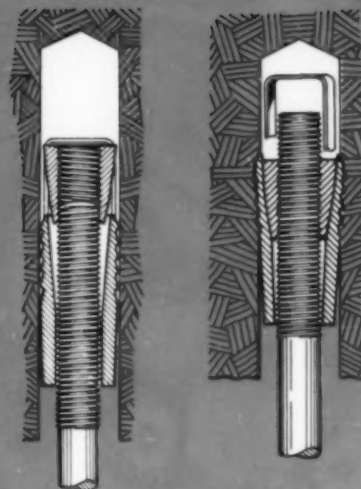
Standard Unit

bolt diameter: $\frac{5}{8}$ and $\frac{3}{4}$ inch—
hole diameter: $1\frac{3}{8}$ inch

O-B Standard Expansion Shells and Plugs are furnished factory pre-assembled with the plug forced down in the shell as shown in the sketch above. This factory pre-assembly slightly pre-expands the shell fingers to assure contact against the sides of the bolt hole during installation.

To install on the bolt:

1. Thread the assembly two or three full turns on the bolt as shown in the left-hand sketch.
2. Break shell away from plug, allowing it to rest on the upset ears or Palnut.
3. Adjust, if necessary, by turning plug to get proper $3/16$ -inch overlap between shell and plug.



Bail-Type Unit

bolt diameter: $\frac{5}{8}$ and $\frac{3}{4}$ inch—
hole diameter: $1\frac{3}{8}$ inch

O-B Bail-Type Expansion Shells and Plugs are also furnished factory pre-assembled with shell fingers slightly pre-expanded to make firm contact with the sides of the hole during installation. A wax-impregnated, sleeve around the unit holds plug and shell in proper position for assembly on the bolt.

To install on the bolt:

1. Thread plug three or four turns on the bolt as shown in the drawing above.
2. Slide off water-repellent sleeve. The steel bail automatically holds plug and shell in correct relationship with each other.



Before pull test begins, bolt hole is checked with an O-B Hole Gage (see back cover) to make sure hole is of normal size and shape.



Bolt is installed and tensioned as usual, then hydraulic ram is attached to bolt head.

Press
bolt—
and E

Wrenching

It's important to make sure that bolt head and roof plate bear firmly against the roof before wrenching begins. Otherwise the bolt will simply thread itself through the plug for a number of turns without becoming tensioned. Then, when it finally does begin to tension, there may not be sufficient thread left to develop full tension or complete expansion of the anchor.

Excessive upward pressure of the wrench against bolt head or plate should be avoided, since this creates additional friction and decreases the torque available for actually tightening the bolt.

Checking Torque

Spot checks with a torque wrench should be made periodically to determine if bolt tension has increased or decreased behind the working faces.

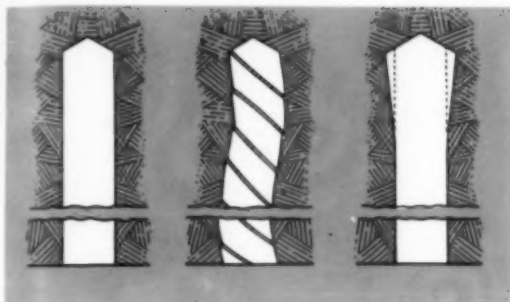
An increase in tension will usually indicate that roof action has occurred. A decrease in tension may also be due to roof action or to plastic flow of roof materials in which the bolt is anchored.

Spot checking with a hand torque wrench will quickly reveal if tension drop-off in any area has proceeded far enough to warrant re-tightening. Newly installed units right at the face should also be spot checked at frequent intervals to make sure the torque setting of the wrenching machine is accurate.

Bolt Pull Test

Perhaps the most comprehensive test of over-all bolting procedure is the bolt pull test. Here the bolt and expansion unit are subjected to abnormally high loading to determine the actual strength of a complete installation.

One of the many pull tests with O-B Expansion Shells and Plugs is illustrated in the pictures at the bottom of these pages.



Hole Size

No factor is more important to successful bolting than the size and shape of the bolt hole. For this reason, every care should be taken to avoid undesirable variations caused by improper drilling. Worn bits, loose jointed drill extensions, or drill "whip" may cause undersize holes or "dog-legged" or rifled holes. Oversize holes may be caused by bits that are ground off center or with one short cutting lip, or by allowing a bit to spin or "dwell" too long at the point of anchorage.

Periodic checks of hole size with an O-B Hole Gage like the one shown on Page 4 reveal these faults before they become serious enough to cause trouble.

Bolt Installation

Expansion units should be turned on the bolt just far enough to start the thread correctly and secure the proper relationship between shell and plug. For the O-B Standard Unit, this means that the plug should be turned on the bolt until the shell (resting on upset ears or Palnut) overlaps the lower end of the plug by about 3/16 inch. For the O-B Bail-Type, this means just three or four turns on the bolt, no more.



Pressure gage shows almost 27,000 lbs. tension on bolt—three times normal installed tension! O-B Shell and Plug holds fast until bolt breaks.



Close-up of broken bolt shows how it stretched and "necked down" before breaking. Test indicates good bolting procedure—and a good expansion unit!

O-B BOLTING ACCESSORIES



O-B HOLE GAGE

A device for measuring bolt hole diameter accurately at the point of anchorage. Gage is inserted in hole, inner rod is pushed up until metal cone on end forces three steel balls against wall of the hole. Hole diameter is then read off calibrated rod end.

Catalog
Number

Description

22134	Basic Gage for measurement of bolt hole diameter ranging from 1 1/4 to 1 3/4 inches.
22135	12-inch Gage Extension
22136	24-inch Gage Extension
22137	36-inch Gage Extension



O-B ROOF PLATE HOOK

For supporting trailing cable or pipe up to 2 1/2 inches in diameter. Serrated support arm is driven between roof plate and roof to make a strong, firm support which can be recovered and used again. Made of malleable iron.

Catalog
Number

Description

22753	O-B Roof Plate Hook
-------	---------------------



O-B ADAPTER FOR 1-INCH ROD

For supporting insulated hangers, feeder slings, and other fittings from 1-inch threaded rods. Tapped boss, 5/8 inch stud.

Catalog
Number

Description

22155	O-B Adapter for 1-inch Rod
-------	----------------------------



O-B TYPE-K-3 INSULATED HANGER

For supporting and insulating electrical lines. Boss is tapped for 3/4 inch threaded rod, 5/8 inch stud holds a wide variety of O-B slings and clamps for feeders and trolley wires.

Catalog
Number

Description

22015	O-B Type-K-3 Insulated Hanger
-------	-------------------------------



Lengths of steel strap, pre-drilled on 4-foot centers, are used in the development entries shown here to provide better protection from small rock falls.

O-B SHELLS & PLUGS



STANDARD UNIT for 1 3/8" bolt hole

Catalog Number	Bolt Dia.	Wt. Lbs. Per 100
22752	5/8	40
22785	3/4	40



BAIL TYPE UNIT for 1 3/8" bolt hole

22770	5/8	42
22791	3/4	42

Note

Shipped as shown in Cartons of 50.





705-BDT "70 TONNER"

.... means safe, fast production

KW-DART's lower center of gravity and perfect balance mean real roadability—greater stability is appreciated by operators in terms of confidence and safety—to superintendents and management it means high volume production with safety... more tons per hour over longer periods of time—and less damage to haul roads.



505-BDT "50 TONNER"

For years the country's most popular coal hauler. Air-operated door for release and take-up. Check the performance records—this hauler rates highest in economy of operation.

— KW-DART — TRUCK CO. —

1301 North Manchester Trafficway
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P.O. Box 321
153

People in Coal



NCA Appoints New President

Clarence M. Hays, chief engineer, Pittsburgh Coal Co. Div. of Consolidation Coal Co., retired Sept. 30 after 33 yr of continuous service with the firm and a predecessor organization. After graduation from Pennsylvania State University with an M. E. degree, Mr. Hays started his lengthy career with H. C. Frick Coke Co., leaving that firm to serve in World War I. Upon returning from service he associated himself with Republic Steel Corp., and joined Union Collieries at Oakmont, Pa., in February of 1926. In successive promotions he became chief engineer of Union Collieries in 1934 and moved to the Pittsburgh Coal Co. Div. in that position when it merged with Union in 1945.

Mr. Hays resides in Mt. Lebanon, Pa.

John R. Palin, who has been associated with the Pittsburgh Coal Co.'s engineering department for some time, was appointed chief engineer, succeeding the retiring C. M. Hays. Mr. Palin, a Penn State graduate in engineering, class of 1937, started his career with Goodman Mfg. Co. and worked for a short time with Baton Coal Co. before joining the Air Force with which he served in World War II. Upon his return from service he affiliated himself with Consumers Mining Co. (now Harmar Coal Co.) in 1946. Mr. Palin, who for the past several years has been assisting Mr. Hays, is a member of the Engineers Society of Western

STEPHEN F. DUNN has been selected by the National Coal Association as president, effective Jan. 1, 1960. He has resigned his former position as vice president of the National Association of Manufacturers.

Mr. Dunn, hailing from Scranton, Pa., holds a liberal arts degree from Cornell University as well as a degree in law from the University of Michigan. He has practiced law privately, and during World War II was appointed industry member of the War Labor Board for the Detroit regions.

From 1939 to 1946 he was counsel and consultant for the Furniture Manufacturers Association, Employers Association of Grand Rapids, Furniture Mutual Insurance Co. and the Metals Mutual Insurance Co. President Eisenhower appointed Mr. Dunn general counsel of the Department of Commerce in January, 1953, and in September of 1954 he returned to private law practice. He joined NAM as vice president in charge of government relations and head of the Washington office in June, 1957.

Well known in government-labor-management relations, Mr. Dunn has lectured on this subject throughout the nation. He is a member of the Advisory Council of the New York State School of Industrial and Labor Relations at Cornell and a member of the Labor Law Section of the American Bar Association. Mr. Dunn is married and has two daughters.

As president of NCA, he will be chief executive officer and an ex officio member of the Board of Directors. He will be the operating head of the six major departments in the reorganized NCA, these including: fiscal management, government relations, marketing, public relations, research and transportation.

Pennsylvania. He and his wife live with their 4 sons and 3 daughters at Dorseyville, Pa.

H. C. McCollum, vice president of Peabody Coal Co., has been elected president of the Illiopolis Mining Institute of Illinois. He replaces A. G. Gosard of the Mid-Continental Coal Corp. Murrell Reak, assistant director of the State Dept. of Mines & Minerals, was named to the executive board of the Institute.

Arlie Webb of Hazard, Ky., recently inspector-in-charge of the Hazard, Ky., office of the Kentucky Dept. of Mines & Minerals and formerly district mine



**NOW! HERE'S AN ITEM THAT MEANS EXTRA SAVINGS!
It's The NEW REVERSIBLE RATCHET**



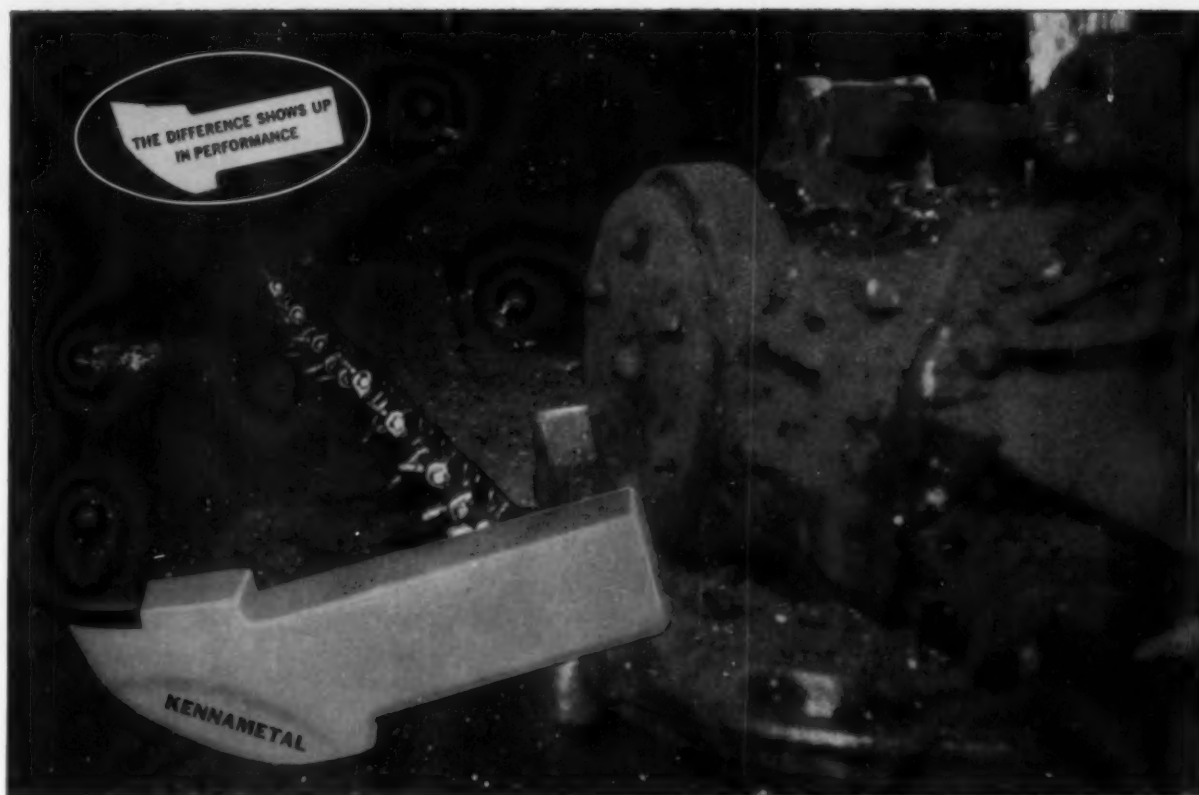
PAT.
PENDING.

BIT WRENCH

... costs less to change bits on continuous mining and cutting machines. Now! you can loosen and tighten the set screws without removing the Wrench. Exclusive ratchet design changes direction of stroke in an instant. Works on any machine with $\frac{3}{4}$ " set screws. Fast, strong operation with solid, steel forged handle 18 $\frac{1}{2}$ " long. Fits into openings where side clearance is only $\frac{1}{2}$ " ... box end handle design for "sledgehammer" jobs. Send for literature and prices—FREE.

Manufacturers of Mining
Machinery Parts
Design and Engineering
Service Available

NORTH AMERICAN GEAR COMPANY
39 East Campbell St., Blairsville, Pa.



Kennametal U4 Bits installed on the 9-foot bar of a universal cutter

Fast cutting KENNAMETAL U4 Bits cut 30% more places every shift

Using other bits, 10 or 12 places a shift was the best that two men could cut from the Lower Kittanning Seam near Philippi, West Virginia. Seam thickness averages 44 inches, with rooms being driven 20 feet wide.

Despite the rolls of fire clay that make under-cutting difficult, a switch to Kennametal U4 Bits increased the average to 16 places a shift. They have cut as many as 21 a shift.

As indicated by the graph, increased production has made a big profit difference. Bit costs have dropped too . . . down to 1.4 cents a ton. And the company reports less fines and reduced wear on the bit blocks.

Let the Kennametal difference show up in performance at your mine. Your Kennametal Representative will help you select and actually test Kennametal bits in your mine. You can't judge performance by appearance or a price tag. Call him, or contact us direct. KENNAMETAL INC., Mining Tool Division, Bedford, Pa.

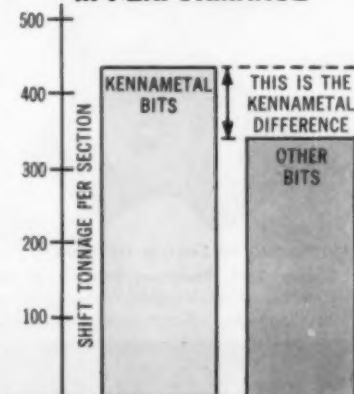
- Consistently high quality keeps Kennametal bits in service longer . . . resulting in fewer bit changes and more operating time at the face.

- Free-cutting design of Kennametal bits draws less power, permits faster cutting, maximum production, less maintenance.

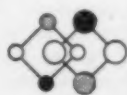
- Every Kennametal bit is backed by 21 years of leadership in tungsten carbide tooling, including the development of the first carbide cutter bits for the American mining industry.

- Nineteen full-time Kennametal Representatives and the Kennametal Distributors—leading mine supply companies, provide assistance in solving your cutting and drilling problems . . . the tools you need . . . when you need them.

The difference shows up in PERFORMANCE



For this mine, Kennametal Bits mean the difference between 324 tons and 432 tons . . . 108 tons from a section, every shift!



INDUSTRY AND
KENNAMETAL
...Partners in Progress



VICTAULIC[®]

METHOD OF PIPING



VICTAULIC HAS EVERYTHING...



VICTAULIC COUPLINGS

Simple, fast, reliable. Styles 77, 77-D, for standard uses with steel or spiral pipe, — Style 75 for light duty. Other styles for cast iron, plastic and other pipes. Sizes $\frac{3}{4}$ " to 60".



ROUST-A-BOUT COUPLINGS

For plain or beveled end pipe Style 99. Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".



VICTAULIC SNAP-JOINTS

The new, boltless, speed coupling, Style 78. Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB



VICTAULIC FULL-FLOW FITTINGS

Elbows, Tees, Reducers, Laterals, a complete line—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes $\frac{3}{4}$ " to 12".



VIC-GROOVER TOOLS

Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes $\frac{3}{4}$ " to 8".

PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.

Write for NEW Victaulic Catalog-Manual No.A-11.

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

People in Coal (Continued)

inspector in Pikeville, Ky., has been named itinerant instructor and field representative of the Mayo State Vocational School, Paintsville, Ky. He will also serve as secretary-treasurer of the Big Sandy-Elkhorn Coal Mining Institute and safety director of the Big Sandy-Elkhorn Coal Operators Association.

Stuart T. Saunders, president of the Norfolk & Western Ry., has been elected chairman of American Coal Shipping, Inc., and the A. H. Bull Steamship Co. American Coal was formed in 1956 by Norfolk & Western and two other coal-carrying railroads, several mining firms and the United Mine Workers of America.

John V. McBride has been named to the position of superintendent of auger and strip operations for the Elk River Coal & Lumber Co. He is formerly from Coeburn, Va., where he held a similar position with the Clinchfield Coal Co. Mr. McBride plans to move his family to Widen, W. Va., where Elk River Coal is located.

Obituaries

Joseph Guthrie, prominent Harlan County, Ky., coal man, suffered a heart attack and passed away Oct. 9. Mr. Guthrie, 48, had been in ill health for some time but had felt better in recent months and had been directing construction of a new Harlan County airport. An engineering graduate from the University of Tennessee, Mr. Guthrie and two brothers operated a family mine, Harlan Fuel Co. He was treasurer of Harlan County Airport Commission and was active in numerous other community activities.

Wayne Hess, partner with his father, Blair Hess, in the H&H Coal Co. of Dixonville, Pa., was killed in a private plane crash recently. The privately-owned plane, which was piloted by Mr. Hess, crashed and exploded in a woods near the newly dedicated Jimmy Stewart Airport.

John Hartwell Hillman Jr., 79, one of the nation's leading industrialists, died Sept. 25 of a heart ailment in the Shadyside Hospital, Pittsburgh, Pa. Mr. Hillman formed the J. H. Hillman & Sons Co. in 1913 and at one time operated 15 bituminous mines.

Roy D. Joseph, 61, at one time manager of the Maryland and West Virginia mines of Johnstown Coal & Coke Co., died Oct. 2 in Shadyside Hospital, Pittsburgh, Pa. Mr. Joseph was employed by the Research Dept. of the U. S. Bureau of Mines.



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Coal Abroad

Poles Overcome Coal Transportation Problem

Engineers of the Polish "Central Mining Institute" of Katowice describe their solution to the problem of hydraulic movement of coal.

Professor H. Boreki and engineer T. Radonicky claim credit for achieving the continuous flow of a coal-water mixture without the use of intermediate pumping stations which would add to the cost of such an arrangement.

The "Debienko" coal shaft, site of the experiment, is the first mine where triple-stage wet coal transport has been successful, according to the Polish report. At the base of a verticle pipe system is an excavation. There a conveyor belt carries coal into a dosing mechanism and then into a pipe. Large valves open and close the pipe circuit, which operates

under water pressure of about 853.2 psi.

The verticle pipe, declares the report, carries the water-coal mixture to another excavation and from there to the surface.

It is not possible to draw a comparative cost calculation from this one prototype plant, says the report, but more installations will produce more reliable data. The Debieńko shaft produced 100 metric tph under tests but engineers are confident that capacity can easily be increased to 150 metric tph. Safety within the shaft, it is noted, was increased sharply because of the absence of coal dust.

JAPAN—The Shimonoseki plant of the Mitsubishi Shipbuilding & Engineering Co. is now marketing an automatic coal mining machine, first of its kind in

Japan. With maximum capacity of 200 tph, the loader permits comprehensive operation from digging to loading. Mitsubishi says its new product has a higher

efficiency and is lower priced (\$30,000 for the loader and \$18,000 for the conveyor) than any of the imported German automatic miners now used in that country.

GERMANY—West German officials are said to take a dim view of a French proposal to enlarge European Coal & Steel Community pool to include oil and natural gas. Up to now the pool has been limited to policies concerning coal and steel. But the French, having substantial interests in the Sahara region which begins producing oil and gas on a commercial basis in 1960, are expected to bring pressure on the other members of the 6-nation pool. Observers say that as far as the Germans, already burdened with record amounts of unsold coal, are concerned, the effects of adding these two sources of energy could be drastic.

ENGLAND—Great Britain's ailing coal industry took another body blow recently when the Nationalized gas industry predicted that by 1964 or 1965 it will have reduced coal consumption by about 2.5 million tons to 21.5 million a year. Commenting on experimental shipments of liquid methane gas, Sir Harold Smith, Gas Council chairman, said the venture is as yet uneconomic but that a ship carrying 20,000 tons instead of the current 2,000, would be equivalent of gas made from 2 million tons of coal a year.

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Bower hones bearings to reduce friction; save you money on equipment downtime and maintenance costs

Finish grinding of bearing raceways still leaves minute surface blemishes—"mountains" under magnification. So Bower takes a costly extra step . . . uses a honing process to smooth off these microscopic mountains.

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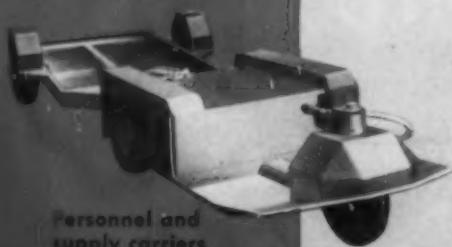


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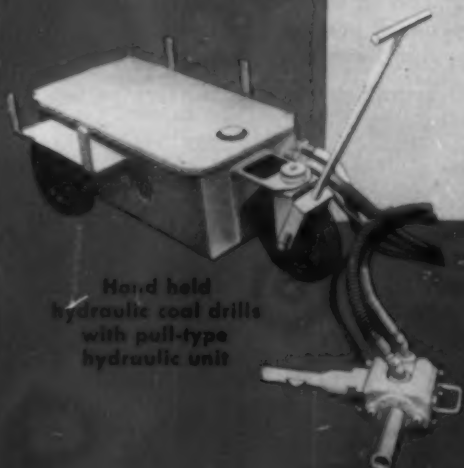
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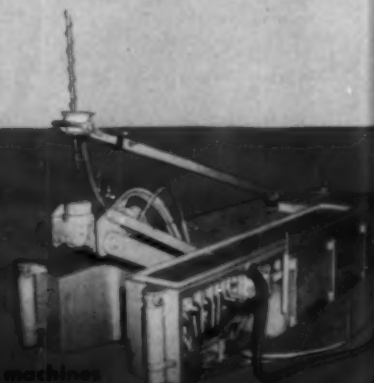
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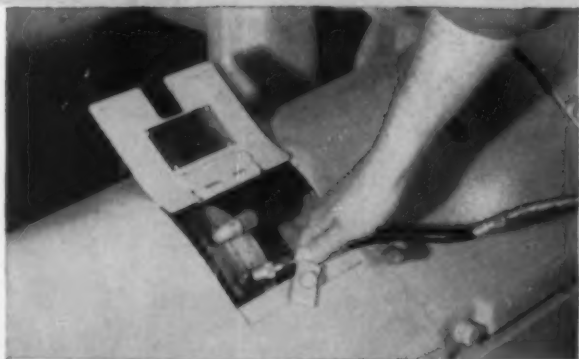
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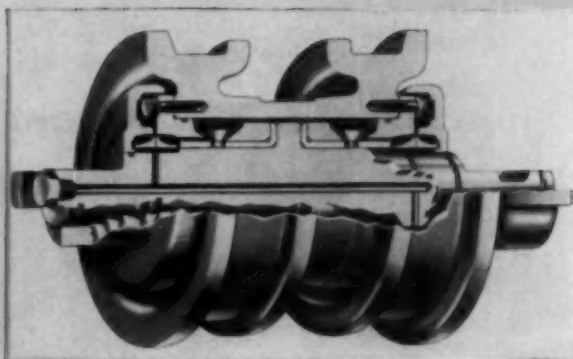


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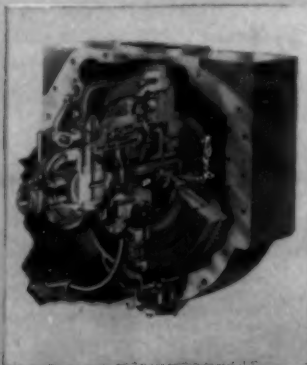
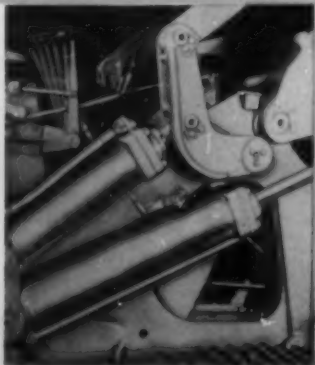


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time and increases maneuverability even in close quarters. Visibility is excellent. The high seat puts the operator on "top" of the work. Operator's compartment is uncluttered. Tractor controls are conveniently located for handling ease. Bucket controls are at the right armrest... closely spaced for dual operation with one hand.

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**BOOST PRODUCTION
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Current Coal Patents

By: Oliver S. North

Rope clamp for rope frame conveyor, J. R. Madeira (assigned to Goodman Mfg. Co., Chicago, Ill.), Sept. 15, 1959. Method of securing the troughing roller assemblies and the spreaders to the rope frame in a positive gripping connection of unitary construction which can be installed by hammer blows or by the use of a wrench and removed by

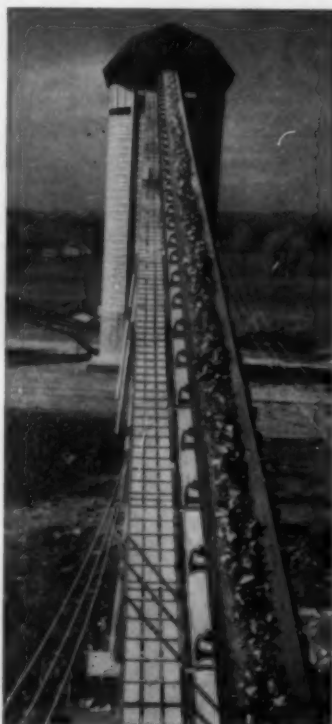
use of the same tools. No. 2,903,769.

Self-tightening clamp, L. D. Hagenbook and R. A. Kopeikin (assigned to Goodman Mfg. Co., Chicago, Ill.), Sept. 15, 1959. Design for an automatically self-tightening clamp connection for attaching elements of a conveyor to a wire rope where the rope forms a part

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of the structural frame of the conveyor. No. 2,903,770.

Belt conveyor troughing roller assembly and locking means therefor, J. R. Madeira (assigned to Goodman Mfg. Co., Chicago, Ill.), Sept. 15, 1959. A troughing roller assembly is arranged so that the load thereon maintains the locking means effective to lock the assembly to the flexible strands. No. 2,903,771.

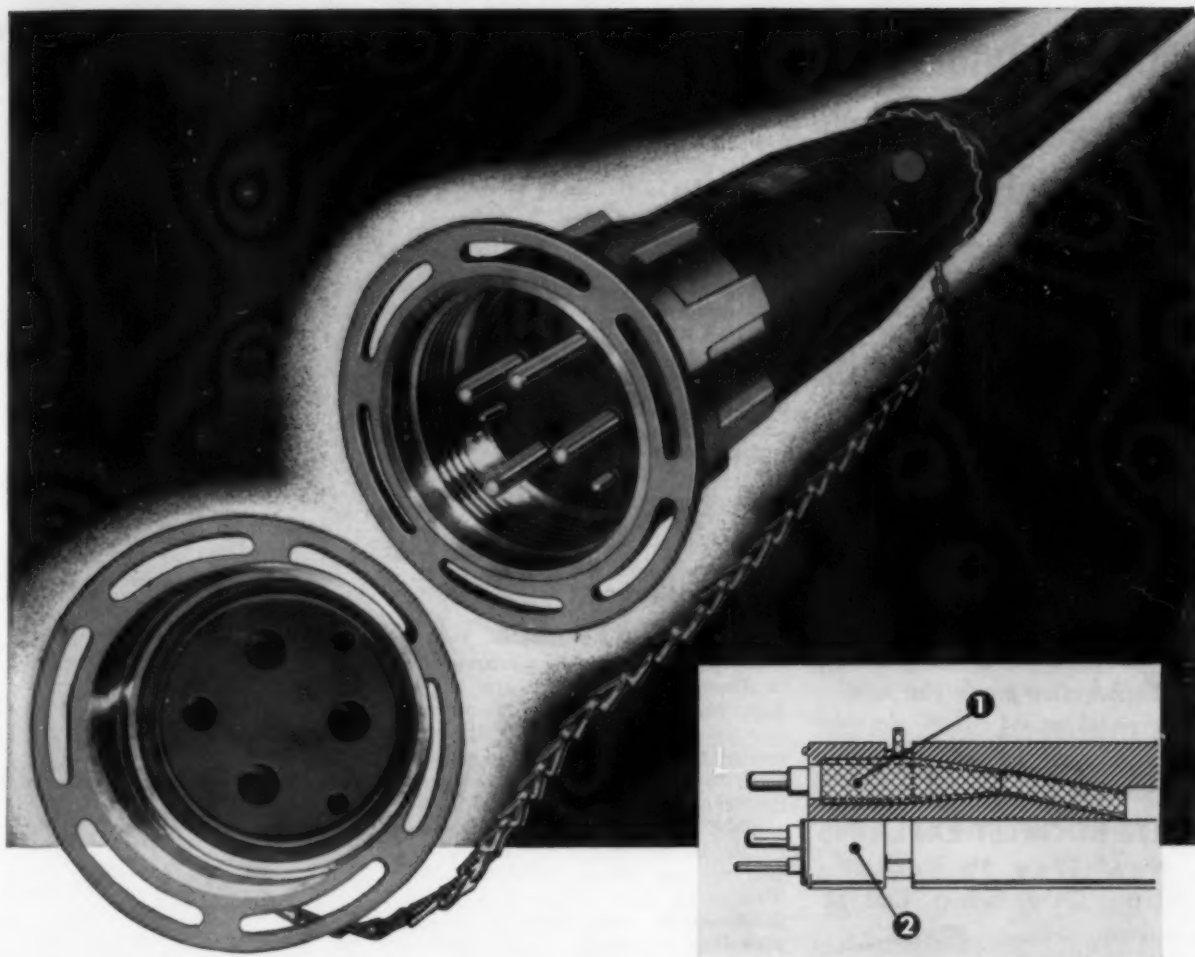
Method of blasting, F. F. Kolbe (assigned to The Maumee Collieries Co., a corp. of O.) Sept. 15, 1959. Improved method for positioning in a blasting hole having at least a slight downward angle an explosive mixture of ammonium nitrate, a liquid hydrocarbon, and nitrogen tetroxide. The liquid constituents are placed in the hole separately in order of decreasing stability, that is, starting with the crystalline or pelletized ammonium nitrate, followed by kerosene, gasoline, or the like. No. 2,903,969.

Combustion of finely divided low volatile carbonaceous solid fuels, E. Gorin (assigned to Consolidation Coal Co., a corp. of Pa.), Sept. 15, 1959. Method for efficiently burning finely divided low volatile char obtained from low-temperature carbonization of bituminous coal or lignite. This method is applicable also to the combustion of anthracite, petroleum coke, metallurgical coke, etc. No. 2,903,980.

Extensible belt conveyors, E. R. Bergmann and J. R. Madeira (assigned to Goodman Mfg. Co., Chicago, Ill.), Sept. 15, 1959. Improved structure for storing and guiding the idler assemblies of the conveyor belt storage loops both during tramming and locating and during set-up and operation of the conveyor. The end section is provided with a pair of rails for receiving the assemblies; thereafter, the rails are pivoted to a position in which the assemblies cannot roll off. No. 2,904,164.

Adjustably supported return idler assembly for belt conveyors, M. L. Stinson (assigned to Goodman Mfg. Co., Chicago, Ill.), Sept. 15, 1959. Improved adjustably supported return idler assembly for the return reach of an endless belt conveyor. The return idler is pivotally supported and therefore capable of a swiveling movement in a generally horizontal plane to exert a force on the belt corrective of misalignment. No. 2,904,166.

Continuous miner with automatic roof support, J. S. Newton (assigned to Goodman Mfg. Co., Chicago, Ill.), Sept. 15, 1959. An apparatus to be used with a boring type mining machine for temporarily supporting the roof until



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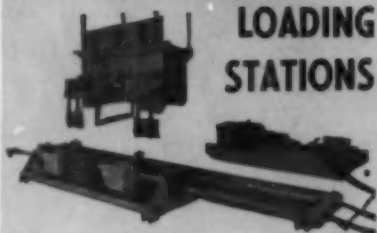
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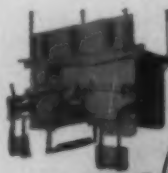
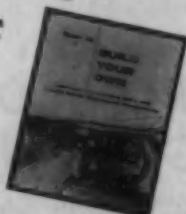
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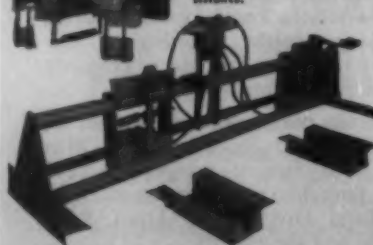
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Coal Patents (Continued)

permanent support can be installed consists of a canopy extending rearwardly from the working face. Alignment is maintained between the cutter bar and canopy, thereby eliminating necessity of making frequent adjustments of canopy height. No. 2,904,319.

Hydraulic powered mining machine, W. N. Poundstone (assigned to Consolidation Coal Co., a corp. of Pa.), Sept. 22, 1959. In a hydraulic-powered mining machine, automatic means is provided for exerting the maximum longitudinal advancing force consistent with the maximum rotational force which the machine is capable of developing. Relatively inexperienced machine operators can be used. Cutting tool abrasion is reduced by avoiding free rotation of the tool under abrasive conditions. No. 2,905,441.

Auger type mining machine, J. A. Swanson and D. P. Graham (assigned to Chemetron Corp., Chicago, Ill.), Sept. 29, 1959. Design for an auger type mining machine which (1) will operate from a narrow bench or pit floor, (2) is so supported as to make tipping or falling thereof virtually impossible, (3) requires no storage space for the augers forming the drill train after the first hole is drilled, and (4) advances an auger into a face while simultaneously withdrawing another auger from an adjacent completed hole. No. 2,906,515.

Mine haulage vehicle, A. L. Lee (assigned to Consolidation Coal Co., a corp. of Pa.), Oct. 6, 1959. Design for a mine shuttle car having improved propelling means adapted to be driven by alternate sources of power, such as A.C. or D.C. electric motors or a diesel engine. No. 2,907,227.

Apparatus for the recovery of fine carbonic fuel particles from slurry by ultrasonic waves, N. Sasaki, Oct. 6, 1959. Apparatus for recovering carbonaceous particles from coal wash plant discharge slurries. Ultrasonic waves are irradiated directly to the slurry, causing cavitation and agitation therein. The carbonaceous particles become flocculated, whereas clays and other mineral matters remain dispersed. The coagulated masses are then recovered by aeration and flotation. No. 2,907,455.

Loading apparatus for tunnel work, J. D. Russell (assigned to Joy Mfg. Co., Pittsburgh, Pa.), Oct. 6, 1959. Design for a loading apparatus especially adapted for use in tunneling work, and having an improved extensible conveyor means for a mobile loading machine. No. 2,907,481.

Continuous miner for pitching seams having an angularly adjustable trimmer bar, E. J. Hlinsky (assigned to Goodman Mfg. Co., Chicago, Ill.), Oct. 6, 1959. Design for a continuous mining machine of the boring type having improved support means for the upper trimmer bar accommodating the upper trimmer bar to cut at the angle of pitch of a pitching seam while the machine operates on the level. No. 2,907,558.

Self-gaging and readily removable cutter bit, C. H. Brown and R. A. McCallum (assigned to Goodman Mfg. Co., Chicago, Ill.), Oct. 6, 1959. Design for an improved cutter chain and cutter bit therefor so arranged as to eliminate the usual set screws to hold the bit in position in the chain and to take the reaction of the cutting against the back side of the socket for the bit. Bits can be inserted and removed without using wrenches. No. 2,907,559.


Method of aggregating carbonaceous material, W. Hartman, Oct. 6, 1959. In the processing of dry coal fines or silt, coke dust, and the like containing less than 10% moisture to form aggregates which will not be readily blown or air borne, the carbonaceous material is mixed with an aqueous solution of spent sulfite liquor in the proportions of 100 parts carbonaceous material to 3 to 7 parts sulfite liquor. The mixture is then pelletized or otherwise formed into suitable masses. No. 2,907,645.

Process for the economic utilization of waste carbonaceous material of fuel ashes, and the resulting products, J. H. Black (assigned to Reading Anthracite Co., Pottsville, Pa.), Oct. 6, 1959. Utilization of fuel ashes or waste carbonaceous products in the production of alloys of metals commonly found in such materials. The method is applicable to (1) ashes recovered from the burning of bituminous coal, lignite, or anthracite, and (2) waste carbonaceous materials, such as coal wastes, coal washery refuse, and similar waste or tailing ordinarily considered worthless. No. 2,907,651.

Process of producing coke from a mixture of coke breeze and coal, E. Schulz, Oct. 6, 1959. In the production of coke, coke breeze is passed between crushing rollers. The crushed breeze is separated and the pores thereof filled with coal powder. That product is then mixed with coal and the mixture coked, producing a first grade coke containing a high proportion of coke breeze. No. 2,907,698.

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A roundup story of the fuel cell, including an appraisal of its prospects as a source of central-station power.



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- ☐ I want to "Meet the Man" who can tell me more.

Name.....

Title..... Company.....

Street.....

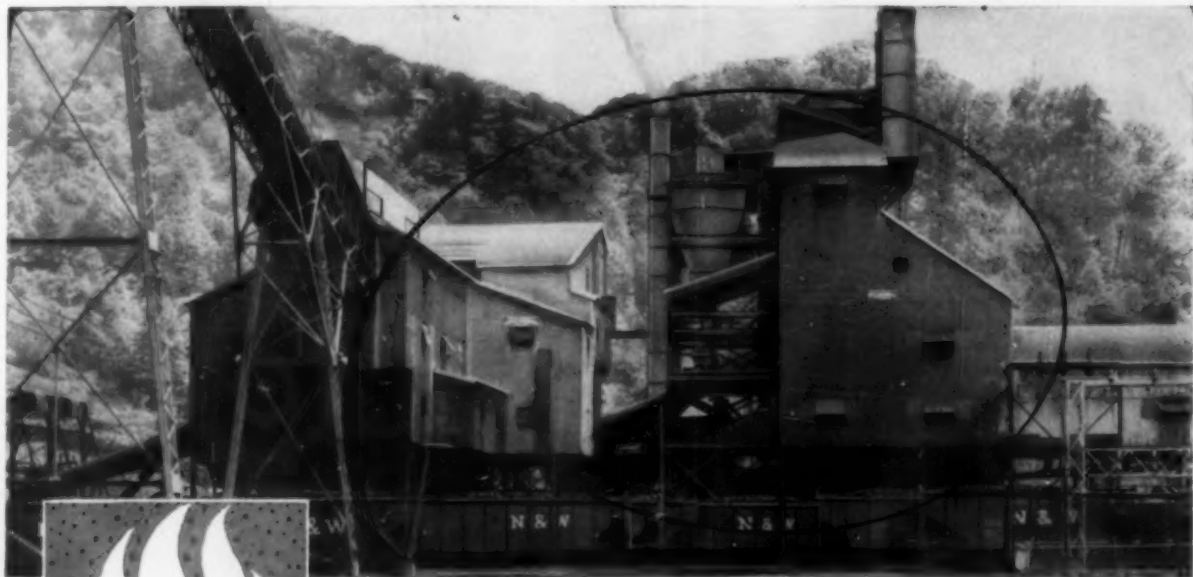
City..... Zone..... State.....

C-E *Flash Drying*

gives BLUE BOY

its highest BTU's—lowest utilization and transportation costs

Example: ISLAND CREEK COAL SALES CO.



WRITE FOR OUR COAL DRYING BULLETIN

C-E Raymond Flash Drying Units provide a clean and safe automatic system without coal degradation. For small and large plants. High thermal efficiency — low maintenance cost.

By greatly reducing the extraneous moisture due to washing, BLUE BOY and other Island Creek coals are today assuring industrial and metallurgical users of a uniformity in quality coal production not commonly found in their field.

Reduction of moisture through the use of the Raymond Flash Dryer helps to make BLUE BOY slack one of the finest medium volatile coals for metallurgical purposes.

The reduction of moisture assures the highest BTU's at the time the coal is weighed. There is no added transportation cost due to the excess moisture. Utilization and handling costs are minimized and reduced.

COMBUSTION ENGINEERING, INC.

Raymond Division

1132 West Blackhawk St.
Chicago 22, Illinois

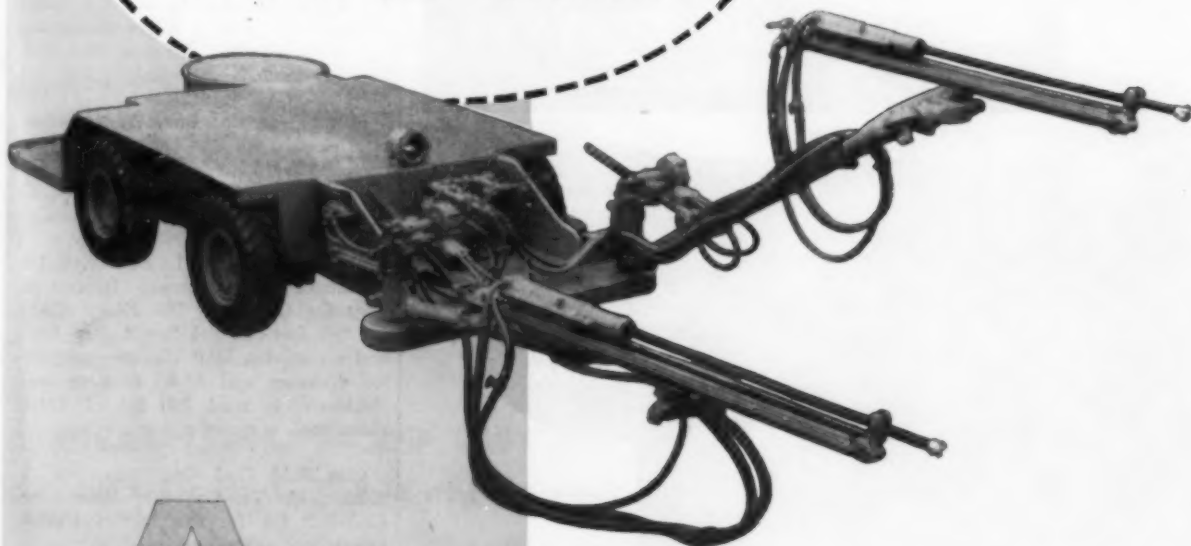
Combustion Engineering-Superheater Ltd., Montreal, Canada

Sales Offices in
Principal Cities

ANOTHER **ACME** DOLLAR SAVER

the **NEW**
JUMBO DRIFTER

that keeps pace with
the rest of your equipment



ACME MACHINERY COMPANY



This new ACME Jumbo Drifter is a self-propelled drifter type rig for drilling rock headings or brushing top with greater speed, less effort and at lower cost.

It is equipped with four-wheel tractor type drive — either electric or air motor. Available with manual or power arm movement. Power-screw type feed or chain feed is optional, in varying lengths with 3" or 3½" bore drifters. Boom centers are rigged to your specific conditions. Height and grade requirements can be maintained with advance of section.

Acme builds a drill rig to suit YOUR mining conditions.

ACME MACHINERY COMPANY

HUNTINGTON, WEST VIRGINIA

WAREHOUSE AND SALES OFFICE
MORGANTOWN, W.VA.

• REPRESENTATIVES IN PRINCIPAL
MINING AREAS

CRUSHING FACTS

on *American* COAL CRUSHERS

Crushes 4000 tons
of coal in 7 hour day.
Exceeds rated capacity
by 32%, reducing
8" x 1 1/4" coal
to 1 1/4" x 0".



In 18 months,
this crusher reduced
1,162,572 tons of
6" x 1 1/2" coal to
2" x 0". Replacement
parts amounted
to only \$418.00.



Without a repair
or replacement part,
this crusher reduced
over 550,000 tons of
minus 8" lignite to
a 3/4" product.



*When you figure costs, the best results come from
American Rolling Ring Crushers*

American  **PULVERIZER COMPANY**
ORIGINALS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS
1119 MACKLIND AVE. ST. LOUIS 10, MISSOURI

Preparation Facilities

Armco Steel Co., Montcoal, W. Va.—Contract closed (through Kanawha Mfg. Co.) with Western Machinery Co. for Wemco Fagergren flotation equipment to treat 36 tph of minus 28 mesh x 0 coal fines.

Eastern Gas & Fuel Associates, Wharton, W. Va.—Contract closed (through Kanawha Mfg. Co.) for Wemco flotation equipment to treat 40 tph of minus 14 mesh coal fines.

Tioga Coal Corp., Tioga, W. Va.—Contract closed with The Deister Concentrator Co., Inc., for 1 Concenco No. 77 Diagonal-Deck washing table and 1 Super Duty Diagonal-Deck No. 6 washing table for cleaning 1/4x0 bituminous and for separating between fine coal and heavy-media particles.

Bolt Mining Co., Bolt, W. Va.—Contract closed with The Daniels Co. for a complete DMS dense-media coal preparation plant to produce coal from company mines in central West Virginia.

United Electric Coal Co., Banner, Ill.—Contract closed (through Roberts & Schaeffer Co.) with The Elmco Corp. for 6-ft diameter x 4 disc Agidisc filter and accessories, 16-ft diameter magnetite thickener and 35-ft diameter coal thickener; to treat 300 tph of 1/4x0 clean coal.

Clinchfield Coal Co., Moss, No. 3, Clinchfield, Va.—Contract closed with Link-Belt Co. for froth flotation cells, pumps and other equipment to handle 160 to 180 tph of 48x0 coal.

Equipment Approvals

September

Ensign Electric & Mfg. Co.—Type JGGGG distribution box; 220-/440 V, AC. Approvals Nos. 2F-1497 and 2F-1497A, Sept. 1.

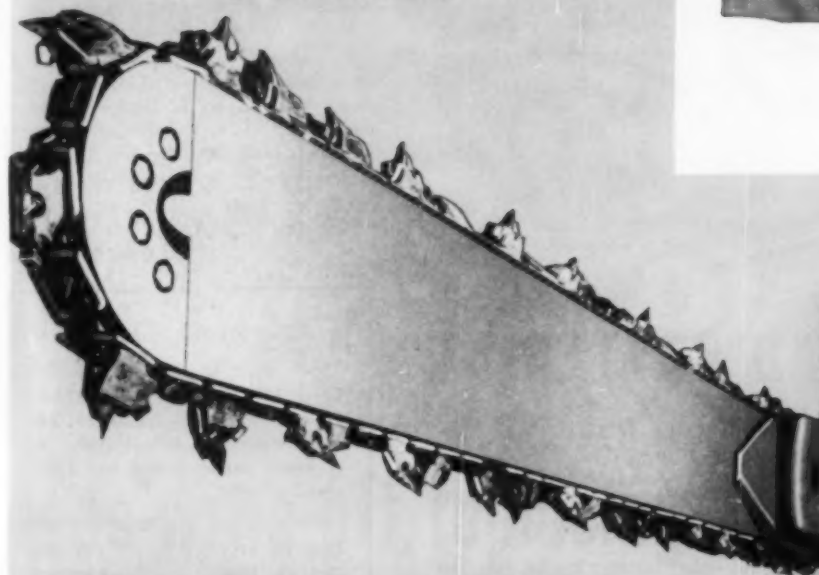
Goodman Mfg. Co.—Type 93-T19K-38 rope belt conveyor; one motor, 50 hp, 440 V, AC. Approval No. 2F-1498A, Sept. 2.

Acme Machinery Co.—Model 325RA4J rotary air compressor; one motor, 90 hp, 240 V, DC. Approval No. 2F-1499, Sept. 3.

The Jeffrey Mfg. Co.—Type MT90 shuttle car; three motors, each 20 hp, 415 V, AC. Approval No. 2F-1500A, Sept. 16.

The Jeffrey Mfg. Co.—Type ML81-C

it's what's up front
that **cuts!**



BOWDIL 1-29 BITS . . .

CONCAVE SHAPE STAYS SHARP AS IT WEARS AWAY. THAT MEANS

- | | |
|---------------------------|------------------------|
| 1. EASIER CUTTING | 6. LESS DRAG |
| 2. FASTER CUTTING | 7. LESS POWER CONSUMED |
| 3. COARSER CUTTINGS | 8. LESS DOWN TIME |
| 4. MORE PROFITABLE STOKER | 9. LESS MAINTENANCE ON |
| 5. LESS BUG-DUST | MINING MACHINES |

. . and the double point doubles your savings!

The **BOWDIL** *Company*
CANTON, OHIO

*
ORIGINATORS OF THROW-AWAY BITS; MANUFACTURERS OF BARS,
BITS, CHAINS AND OTHER PRODUCTS FOR COAL MINING; CUSTOM
MACHINERY DESIGNERS AND BUILDERS; HEAT-TREAT SPECIALISTS;
SALES AGENTS FOR THE CINCINNATI ELECTRIC DRILL



EXIDE-IRONCLAD BATTERIES

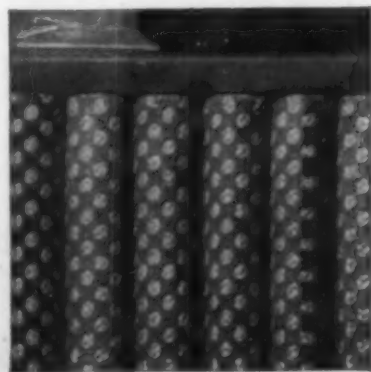
—best buy for the long haul

More ton-miles per dollar—that's the reason most cost-conscious mine operators prefer Exide-Ironclad Batteries for mine locomotives.

Experience has proved over the years that no other battery make matches Exide-Ironclad for average life in service and tonnage hauled. Rating for rating and dollar for dollar, Exide-Ironclad gives you more real value . . . more return on your investment.

Today's Exide-Ironclad features improved tubular construction, making it even better than the models that chalked up the industry's records. So you can expect even longer life potential and superior performance.

Total work output, not mere price, is the key to battery economy. When you buy batteries, specify Exide-Ironclad and get the most production capacity your dollar can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



50 years ago, Exide patented the now-famous Exide-Ironclad tubular positive plate battery. For power and economy, nothing has ever matched it. Yet Exide engineers have constantly improved it. Today's battery packs more power, gives longer life and greater economy than ever before.

Exide®

Equipment Approvals (Continued)

loading machine; five motors, four 15 hp and one 6 hp, 500 V, DC. Approval No. 2F-1501A, Sept. 25.

Megator Pumps & Compressors, Inc.—Model M-50 mining pump; one motor, 5 hp, 440 V, AC. Approval No. 2F-1502A, Sept. 29.

The Long Co.—Type TDF-25 face drill; one motor, 25 hp, 440 V, AC. Approval No. 2F-1503A, Sept. 30.

In addition to the above permissible equipment, acceptance designation No. 28-28 was assigned to Rubber Improvement Ltd., of Great Britain, to identify conveyor belts which have been accepted by the Bureau as being fire resistant.

Bituminous Output

YEAR TO DATE	PRODUCTION
Oct. 17, 1959.....	314,632,000
Oct. 18, 1958.....	318,581,000
1959 output 1.2% behind 1958.	
A month earlier output was 2.0% ahead of 1958.	

WEEK ENDING	PRODUCTION
Oct. 17, 1959.....	7,870,000
Oct. 18, 1958.....	8,700,000

Anthracite Output

YEAR TO DATE	PRODUCTION
Oct. 17, 1959.....	15,123,000
Oct. 18, 1958.....	16,872,000
1959 output 10.4% behind 1958.	
A month earlier output was 9.4% behind 1958.	

WEEK ENDING	PRODUCTION
Oct. 17, 1959.....	365,000
Oct. 18, 1958.....	464,000

With Our Hats in Our Hands...

. . . we blushing offer a correction. If you have not already figured it out for yourself, please be advised now that pages 94 and 96 in our October, 1959, issue of *Coal Age* should be interchanged. We left you cliff-hanging at the bottom of page 93, and we are sorry. You may wish to remove these two pages from your personal copy of the issue, interchange them and tape them back into the book in proper sequence. And not only that—the captions under Figs. 1 and 3 on page 96 should be interchanged. Never, but never, connect an ammeter across the line.

Walker Cut Stone Co., Milford, Kansas, replaced six smaller overworked gasoline haulers with only two 19-ton Model 65 Payhauler trucks! Their "65's" deliver 150 tons of limestone per hour, from quarry to crusher.

How new rock-ribbed 65 Payhauler® pair



speeds "write-off," replacing six smaller rigs!

—for Walker Cut Stone Co., Milford, Kansas

Two new International 19-ton 65 Payhauler trucks—with the new weight-saving corrugated bodies, and the new 250-hp D-817 diesel engine—have replaced six smaller gasoline trucks for Walker Cut Stone Co., Milford, Kansas.

Results are amazing! Only two operators instead of six to pay! Only 40 gallons of low-cost diesel fuel used daily (total) by the two Payhauler rigs—against several times 40 gallons of high-priced gasoline formerly swilled by the carbureted outfits! And only two machines to maintain, instead of six! "Write-off" of the Payhauler investment speeds in "high gear!"

Payhauler features increase capacity!

Even against competitive haulers of similar rated

capacity, the new 65 Payhauler gives you overwhelming advantages!

Of all off-road haulers in its size class, only the 65 Payhauler has the International-developed rock-ribbed corrugated body! This strength-multiplying principle lets the "65" shed 5,000 lbs. of power-wasting weight, and gain a full ton of payload capacity.

Prove the power-to-payload advantages the new rock-ribbed 65 Payhauler delivers! Compare the "65's" cycle-speeding combination of air-assist shifting; 11-second dumping, fast reversing; super-power braking; bonus-leverage, vibration-free power steering! And for 27-ton capacity, note how the 375-hp "95" leads the field. See your International Construction Equipment Distributor for a demonstration!



In only 11 seconds you dump the "65's" 19-ton load—with 3-stage, double-acting, constant-power hoist! Positive up-and-down snubbing guards against impact!



International Construction Equipment

International Harvester Co., 180 North Michigan Avenue
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom-Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

YOU ARE INVITED TO

TD-25 OPEN

NOVEMBER 30-DECEMBER 5



HOUSE, U.S.A.

INTERNATIONAL HARVESTER COMPANY
180 NORTH MICHIGAN AVENUE • CHICAGO 1, ILLINOIS

An open invitation to profit-conscious contractors

At Open House, U.S.A., you won't be viewing "just another big tractor." Not on your life! This is the big, new International TD-25's "coming out party." And the "25" is coming out "loaded for bear!"

At Open House, U.S.A., you'll preview a king-sized crawler that has more proven, high-output exclusive features than anything else on tracks... The new TD-25 is:

- the only king-sized crawler powered by the new 230-hp, 6-cylinder, direct-start DT-817 diesel--loaded with capacity-adding, life-prolonging features no other engine has!
- the only king-sized crawler with world-proved Planet Power steering, that gives you fingertip power-steering and Hi-Lo, on-the-go power-shifting. Full-time "live" power on both tracks adds payload capacity as no other crawler can!
- the only king-sized crawler with International-developed double-box-beam track frames, the industry's strongest; the only one carried on Dura Rollers--the rollers you can power-lubricate without affecting seal life or efficiency
- the ones that make 1,000-hr lube checks practical!
- the only king-sized crawler with so many far-ahead features it can outearn competitive rigs up to 50%, on an amazing variety of tough jobs!

Watch for the word on when and where your Distributor will hold TD-25 Open House, U.S.A. And be there, for sure. Be one of the first to size up the profit-making advantages of the big, new International TD-25.

More productive power to you!
International Harvester Company



**International[®]
Construction
Equipment**

International Harvester Co., 180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

"DUSTLESS" S 20 STOPER is available with 28-, 46-, and 64-in. feeds... weights; 65, 78, and 88 lbs. It can be used for fast, dustless roof-bolting wherever a man can crawl!



LIGHT

SHORT

LE ROI
S 20
STOPER

DUSTLESS

• drills in 26-in. coal • delivers lightweight power • cuttings never pass through stoper

The thousands used in coal mines prove that the Le Roi S 20 Dust-Collecting Stoper is the shortest, lightest, and the only practical stoper for 26-in. seams!

Le Roi's Vac-Nu-Matic® dust-collection is fast, positive — reduces wear on men and machines. Perfect dust removal minimizes rotational drag, eliminates stuck steel, and speeds drilling even in soft, wet formations. The S 20 removes dust through the chuck housing — not through the stoper — drills deeper with one steel change than conventional stopers can with two! Its design permits chuck changes without dismantling the machine.

Call your Le Roi distributor for more information — and a demonstration. Or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

LE ROI
NEWMATIC®
.....
AIR TOOLS



PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS
Distributed in the Coal Fields by: Acme Machinery Company, Huntington, West Virginia, and Equipment Service Company, Inc., Birmingham, Alabama.

AT-603



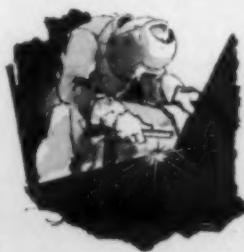
GET TOUGH

WITH LUKENS "T-1" STEEL

TRADEMARK

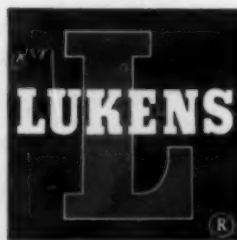
Where the going gets rough, versatile Lukens "T-1" steel fights back. For repair or modification of heavy duty equipment such as truck beds, chutes, bucket teeth and dozer blades, this special duty steel plate can be ordered from warehouse stock in a wide range of plate sizes and gages. Lukens "T-1" is the modern mining steel—you can work and weld it in the field as readily as in your shop. Its terrific

resistance to abrasive impact—coupled with an extremely high yield strength—means fewer replacements and often greater payloads. That's why more and more equipment builders are using Lukens "T-1" to provide longer life in shovel buckets, trucks and other mining equipment. Remember to specify the extra-tough 321 min. BHN quality. For performance and application details, request our special booklet, "Lukens 'T-1' for Toughness." Address Manager, Application Engineering Dept., M119 Services Bldg., Lukens Steel Company, Coatesville, Pennsylvania.



These warehouses can supply you with Lukens "T-1" steel plate...

Alabama, BIRMINGHAM 2, O'Neal Steel, Inc., P.O. Box 2623 • California, LOS ANGELES 54, Earle M. Jorgensen Co., P.O. Box 2358, Terminal Annex, 10650 S. Alameda St. • LOS ANGELES 33, The R. J. M. Company, 238-248 South Mission Rd. • Illinois, CHICAGO 8, Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts. • Kentucky, ASHLAND, Mansbach Steel Co., 19th St. and River Front • Maryland, BALTIMORE 2, Wm. G. Wetherall, Inc., 317 President St. • New Mexico, ALBUQUERQUE, Miller and Smith Mfg. Co., Inc., 500 Phoenix Ave., N.W. • Ohio, CLEVELAND 6, Mills-Wolf Steel Co., 12434 Cedar Rd. • Oregon, PORTLAND 4, J. E. Haseltine & Co., 115 S. W. Second Ave. • Pennsylvania, MCKEES ROCKS, Follansbee Steel Co., 200 Bradley St. • Quebec, MONTREAL, Drummond, McCall & Co., Ltd., 930 Wellington St. • Utah, SALT LAKE CITY, Structural Steel & Forge Co., P. O. Box 300 • Washington, SEATTLE 4, Stack Steel & Supply Co., 500 Landers St. • SPOKANE 10, Union Iron Works, East 217 Montgomery Ave., P. O. Box 2135.



News Roundup (Continued)

life of the Virginian and afford more stabilized employment.

Mines, Companies

Peabody Coal Co. has purchased a massive multi-bucket earthmover costing \$2.5 million from Bucyrus-Erie Co.

Peabody plans to use the machine, Model 1054-WX wheel excavator, at its River King mine near Bellerville, Ill. The excavator will incorporate many

features of the Kolbe unit, recently demonstrated by The United Electric Coal Co. at its Cuba mine. Bucyrus-Erie has the rights and patents to the Kolbe machine. Peabody's unit will be about 150 ft in height, 390 ft in length and 50 ft in width. A fast-moving dual conveyor spoil system will be fed continuously by a 24-ft diameter revolving wheel equipped with nine 1-yd self-cleaning buckets, permitting spoiling the material some 400 ft from the cut at a maximum dumping height of 128 ft.

Pittsburgh Coal Co., Div. of Consolidation Coal Co., has asked West Virginia

to sell it 11.7 acres of coal lying beneath the Ohio River.

The firm wants to buy the state-owned acreage near Cresap in Marshall County under plans to expand beneath the river to coal deposits on the Ohio side. A Consol subsidiary now operates a mine at Cresap. Pittsburgh Coal would mine coal from beneath the river, and at the same time drive two entries into the Ohio deposits. All coal removed, including that in Ohio, would be brought to the surface in West Virginia.

Utilization

Pennsylvania Electric Co. plans to build a \$45 million plant at Seward, Pa.

Louis H. Roddis Jr., president, said the 250,000-kw generating station is scheduled for completion after 1964.

Sixteen of the largest construction firms in the nation are bidding for the contract to build the \$85 million anthracite gasification plant Philadelphia & Reading and General Dynamics Corp. plan to establish next year in Schuylkill County, Pa.

Using a Lurgi-type gasification and purification process, the plant will convert anthracite silt into hydrogen and synthetic gas for producing chemical components.

A final order banning the use of 17 coal tar colors in lipsticks on the ground that the colors were harmful has been issued by the Food & Drug Administration.

The order restricts the use of 13 of the colors to drugs and cosmetics that are used externally and have no chance of getting into the digestive tract.

If
YOUR ANSWER
IS
Yes
TO ANY OF
THESE
QUESTIONS...

- ☐ Are you loading by the rope-and-hoist method?
- ☐ Are you loading by the belt-conveyor system?
- ☐ Do you ever have bottle-necks at your loading points?
- ☐ Would you like to cut loading costs?

Then You Should Investigate STAMLER CAR SPOTTERS

Why use fast, modern mining equipment at the face and slow, out-moded methods at the loading point?

When you use STAMLER Car Spotters, you've taken a big step forward in coordinating fast loading with your other modern equipment. Result: perfect "team-play" between your various operations . . . peak efficiency . . . and lowest possible loading costs.



W. R. STAMLER CORPORATION
PARIS, KENTUCKY

STAMLERs will PAY FOR THEMSELVES in your mines. Ask us to prove it.

SCHROEDER BROTHERS, Exclusive Eastern Sales Agent
Pittsburgh, Pennsylvania
UNION INDUSTRIAL CORP., Carlsbad, New Mexico

SALMON & CO., Birmingham, Alabama
WESTERN SALES ENGINEERING CO.,
Salt Lake City, Utah

Meetings

Kentucky Mining Institute, Fall meeting, Nov. 12-13—Phoenix Hotel, Lexington, Ky.

American Mining Congress, Coal Division Conference, November 13—Penn-Sheraton Hotel, Pittsburgh, Pa.

Fifth Symposium on Mining Research treating themes on ammonium nitrate explosives, field performance and safety, Nov. 19 and 20—Missouri School of Mines, Rolla, Mo.

Coal Mining Institute of America 73rd annual meeting, Dec. 3 and 4—Penn-Sheraton Hotel, Pittsburgh, Pa.

American Institute of Mining, Metallurgical & Petroleum Engineers, Inc., annual meeting, Feb. 14-18, 1960—New York, N. Y.

PYROPRENE*

*Acceptance designation: "Fire Resistant, U.S.B.M. No. 28-7"



Always on the move
1,500,000 tons per year

Huge sharp-edged pieces ride over 1/2 mile on the Acme-Hamilton Pyroprene Belt which is running on a Barber-Greene conveyor. Over a million and a half tons of coal a year travel on this belt. Trouble is non-existent. Proof-positive that Acme-Hamilton belts haul top capacity loads for longer periods with no loss of time, or maintenance.

Fire Resistant Pyroprene Compound, used in Acme-Hamilton U.S.B.M. accepted belts, will not feed or spread fire. The cover is Pyroprene; fabric plies and breaker fabric are sealed with Pyroprene before the belt is built. Cover has exceptional resistance to cutting, abrasion and gouging. Write Acme-Hamilton, Dept. CA-92.

Acme

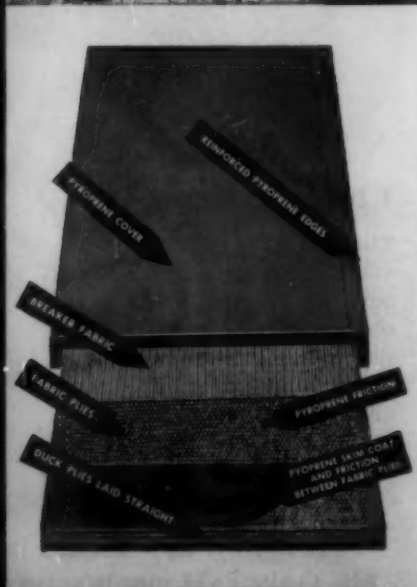


Hamilton

MANUFACTURING CORPORATION, TRENTON 3, N. J.

Divisions: Acme Rubber Mfg. Co. • Hamilton Rubber Mfg. Corp.

ATLANTA • CHICAGO • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES
MILWAUKEE • NEW YORK • PITTSBURGH • SALT LAKE CITY • SAN FRANCISCO • SEATTLE

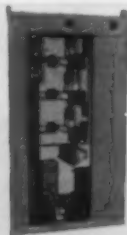


THE BETTER WAY

The P&H way—"the better way" of design and construction puts P&H Electric Shovels in a class by themselves—they alone are not essentially the same as the shovels of a generation ago.

P&H has always been the pioneer developer of dramatic new designs and processes—this is why P&H Electric Shovels incorporate design fundamentals which make them different from all others. By their pioneering, P&H found "the better way" to production premiums as high as 10%, lower unit cost and more net profit for P&H owners.

Some exclusive P&H design fundamentals not found in other electric shovels are:



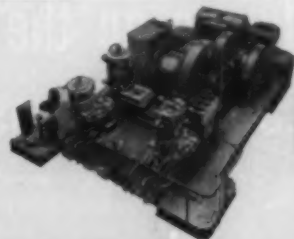
1. ELECTRONIC CONTROL

This patented P&H control accomplishes the quickest work motion reaction time known for electric shovels. Control maintenance expense is reduced as much as 80% by elimination of all moving parts for a completely closed circuit system.



2. MAGNETORQUE® HOIST DRIVE

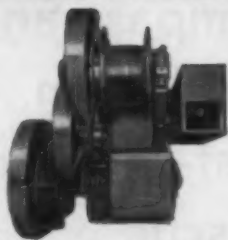
This patented hoist drive electro-magnetically transmits the full digging power of an A.C. motor direct to the dipper without motor generator set conversion to D.C. current! It gives up to 30% higher ball pull for more uniform digging speed and greater dipper fill factor.



3. FULL WELDED STEEL CONSTRUCTION

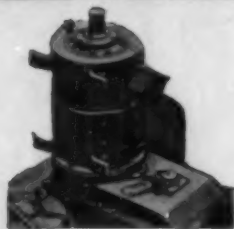
P&H was the originator of electric shovel construction by the unit welded rolled steel method. Their accumulated wealth of experience pays P&H owner dividends in the form of exceptional long shovel life in hard digging—accomplished by full welded steel construction.

"P&H is now the world's largest builder of full-electric and diesel-electric shovels. Only P&H manufactures their own electrical as well as mechanical components—designed specifically for electric shovel service—gives you the service assurance of single source responsibility."



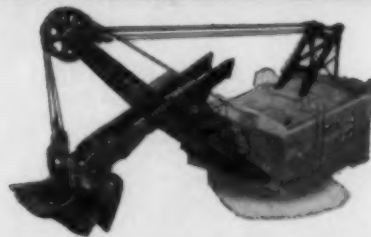
4. ENCLOSED HOIST MACHINERY

Only on the P&H Shovel is all deck machinery—the power trains for hoist, swing and propel drives—enclosed in oil tight gear cases. No open gearings! Modern power train design at its best!



5. INDEPENDENT CRAWLER PROPEL MOTOR

Only P&H Electric Shovels have an independently motored crawler propel drive. P&H gives shovel owners the advantages of independent motoring—the basic principle of electric shovel design and purpose. The P&H is **FULL-ELECTRIC** in every work motion.



6. T-1 STEEL... SHOVEL ATTACHMENT

Only P&H furnishes as standard a boom and dipper handle fabricated of ultra high strength T-1 steel for high impact absorption ability, especially important in sub-zero temperatures. P&H pioneered and is the most extensive user of rolled alloy steels.

P&H MINING EXCAVATORS

HARNISCHFEGGER CORPORATION • Construction & Mining Division • Milwaukee 46, Wisconsin

P&H LINE

Full-Electric and Diesel-Electric
Shovels & Draglines: 3½ through 10 yds.

Diesel Excavators:
½ through 3½ yds.

Truck Cranes:
10 through 80 tons





FIRST-AID CHAMPIONS—Compass No. 1 team, Clinchfield Coal Corp., plus company officials award donors, meet and association officials, and Miss Vicki George, "Miss Mine Safety of 1959" for the Central West Virginia Coal Mining Institute: Calvin Haller (kneeling); C. M. Donohue, Mine Safety Appliances Co. (left, 1st row); Jack Light, Compass safety director; Dale See, captain; Miss George; Francis Skidmore; Audrey Collins; Marling J. Ankeny, director; John J. Dougherty, USBM (left, 2d row); Dick Collins; Harrison Summers; Clifford Haller; John J. Dobis, USBM; L. Clyde Riley (left, 3d row), UMW; Frank Elmond; Blair Hill, institute president, Henry Strubeck, USBM.



MINE-RESCUE CHAMPIONS—Mine No. 22, Bethlehem Mines Corp.: Douglas Damron (left, kneeling); Raymond Litz; C. D. Halbert (left, 1st row), instructor; James Westfield, assistant director, Health & Safety, USBM; Bill Sargent; Albert Childress; Wilmer Donahue; James Phalan, chief, Ky. Dept. of Mines; G. C. Trevor-row (left, 2d row); safety director, Bituminous Coal Operators Association; M. E. Prunty, Bethlehem safety director; James Salyers; Truman Conley; H. E. Childers, No. 22 superintendent.

Compass and Bethlehem First-Aid and Rescue Champs

Winners in the 1959 National First-Aid and Mine Rescue Contest at Buffalo, N. Y., Oct. 5-7, were:

First Aid—Compass No. 1 team, Clinchfield Coal Corp., Clarksburg, W. Va.: Congressional Medallion, U. S. Bureau of Mines and Mine Safety Appliances Co. trophies; *Coal Age and Engineering and Mining Journal* awards.

Mine Rescue—Mine No. 22, Bethlehem Mines Corp., Jenkins, Ky.: Congressional Medallion; U. S. Bureau of Mines



FIRST-AID AND MINE RESCUE—Mine No. 21, Bethlehem Mines Corp.: Warnie Flint Jr. (kneeling); Bill Collins (left, 1st row); Clyde Maggard; Lenville Jones; James Zidaroff; Marling J. Ankeny, director, USBM; M. E. Prunty (left, 2d row), Bethlehem safety director; G. C. Trevorow, safety director, Bituminous Coal Operators Association; John Juffman; C. D. Halbert, instructor; Roy Vinson; Charles Ferguson, director, Safety Div., UMW.

and National Coal Association trophies; *Coal Age and Engineering and Mining Journal* awards.

First-Aid and Mine Rescue—Mine No. 21, Bethlehem Mines Corp., Jenkins, Ky.: Congressional Medallion, U. S. Bureau of Mines and United Mine Workers trophies.

Eighteenth in the series the 1959 competition was sponsored by the U. S. Bureau of Mines and the Joseph A. Holmes Safety Association in cooperation with state mine inspection agencies, management and labor in the mineral-extractive industries and other safety-minded groups. General chairman was Marling J. Ankeny, director, USBM, with L. W. Schuler, assistant to safety director, UMW, as general vice chairman. Chief and assistant judges were:

First-Aid—Clement M. Dovidas and Joseph S. Ferraro, USBM.

Mine Rescue—George W. Colbert, USBM, and Mr. Ferraro.

Master of ceremonies for the contest, banquet and award presentation was Harry Gandy Jr., director, Dept. of Safety, National Coal Association.

Forty-six teams were entered in the three contests. In addition to top honors, other teams receiving awards were:

First Aid

Second Place—Georgetown No. 12, Hanna Coal Co., Cadiz, Ohio; Robert Secrest, captain; Joseph A. Holmes Safety Association trophy.

Third—No. 3 team, Gary Dist., U. S. Steel Corp., Gary, W. Va.; Albert Wagers, captain; United Mine Workers trophy.

Fourth—Mine No. 21, Bethlehem Mines Corp., Jenkins, Ky. (also winners

of the contest for combination teams), Warnie Flint Jr., captain; National Coal Association trophy.

Fifth—Wyoming mine, Island Creek Coal Co., Holden, W. Va.; Willard Graham, captain; Mine Safety Appliances trophy.

Sixth—Nemacolin mine, Buckeye Coal Co., Nemacolin, Pa.; Alex Kott, captain; United Mine Workers trophy.

Mine Rescue

Second Place—Mine No. 21, Bethlehem Mines Corp., Jenkins, Ky.; Kelly De Simone, captain; Joseph A. Holmes trophy.

Third—Inland Steel Co., Wheelwright, Ky.; Clayton Ferguson, captain; Mine Safety Appliances trophy.

Fourth—No. 21 mine, Bethlehem Mines Corp., Jenkins, Ky.; Warnie Flint Jr., captain; National Coal Association trophy.

First Aid and Mine Rescue

Second Place—Holden Div., Island Creek Coal Co.; Harrison Porter, captain; Joseph A. Holmes trophy.

In addition to those receiving awards, the following teams competed in the various events:

First Aid

Indiana—Enoco Collieries, Inc., Bruceville, Ind. (day-shift team).

Kentucky—Bule Diamond Coal Co., Leatherwood No. 1.

Princess Coals, Inc., David mine.

New York—N. Y. Trop Rock Corp.

West Delaware Tunnel Constructors

Ohio—Columbia Southern Chemicals Corp., Midvale mine.

Hanna Coal Co., Piney Fork No. 15.

Powhatan Mining Co., Powhatan No. 3.

Pennsylvania—Bethlehem Mines Corp., Revloc.

Duquesne Light Co., Warwick.

Emerald Coal & Coke Co., Emerald mine.

Harmar Coal Co., Harmar mine.

U. S. Steel Corp., Frick Dist., Robena No. 1 and Robena No. 2.

Virginia—Pocahontas Fuel Co., Amonte colliery, Bishop colliery, Itmann Colliery.

West Virginia—Semet-Solvay Div., Allied Chemical Corp., Tralee and Hargwood No. 1 teams.

Armco Steel Corp., No. 1 and No. 2 teams.

Bethlehem Mines Corp., No. 1 Idamay.

Eastern Gas & Fuel Associates—Stotesbury No. 11 and Wharton No. 2.

Maust Coal & Coke Co., Donegan No. 14.

Mountaineer Coal Co., No. 1 Owings and Consol No. 9.

Reppert-Fairmont Coal Co., No. 1.

U. S. Steel Corp., Gary Dist., No. 2 team.

Combination First-Aid and Mine Rescue

New Jersey—Alan Wood Steel Co., Scrub Oaks & Washington mine.

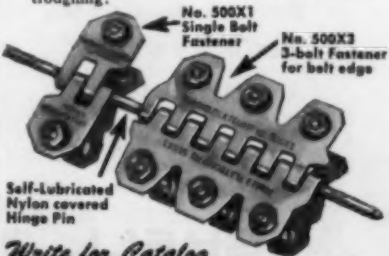
Pennsylvania—Imperial Coal Corp., Diamond mine.

Pittsburgh Coal Co., Library, Pa.

U. S. Steel Corp., Frick Dist.



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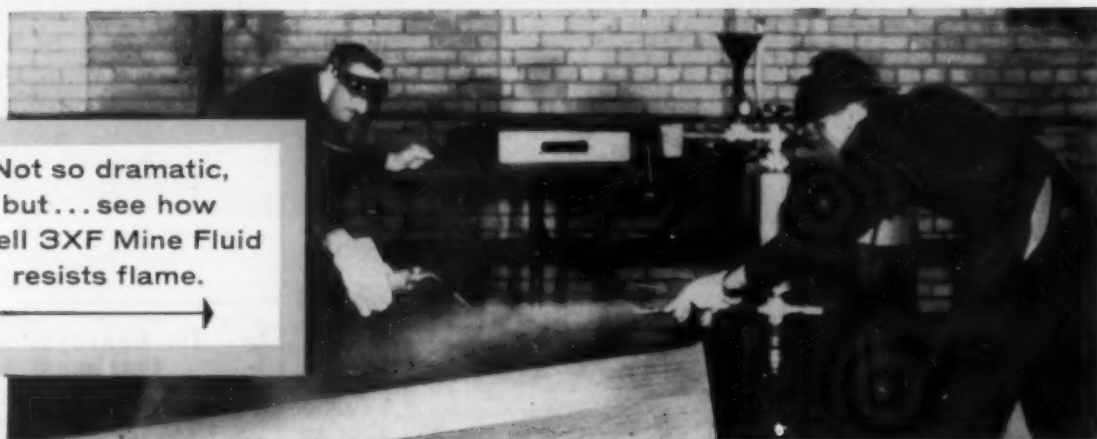
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SHELL 3XF MINE FLUID

NOVEMBER 1959

IVAN A. GIVEN, EDITOR

Now's the Time

GRAVITY'S RELENTLESS FORCE and the shortcomings of man continue to help falls of roof, ribs and face maintain their long-standing rank of No. 1 killer in coal mining. They accounted for over half the fatalities in bituminous in the first 8 mo of 1959 and, excluding the Knox Colliery flood, over a third of the anthracite fatalities in the same period. More than 75% of these fatalities reflected failure to take the tested steps that prevent falls.

There was every reason, therefore, for

the National Safety Council and cooperating agencies to reactivate in 1960 the 1957-58 National Campaign for the Prevention of Falls of Roof. The earlier campaign definitely saved lives and reduced injuries—and would have saved even more had full participation been realized.

Moral: Get ready now—in fact start now—to do the things that will guarantee the absolute minimum in roof-fall injuries and fatalities.

Needed Step

THOUGH MEMBERS of the profession have gone as far as the White House, mining engineering is again being listed in certain quarters as offering fewer opportunities as a career. The natural result is a tendency on the part of young men entering college to choose something else. The next natural result is a reduced supply of the talent which coal mining now needs more than ever.

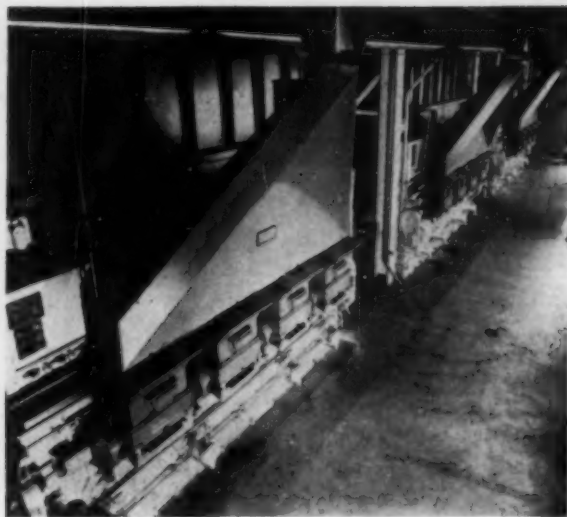
Action? A careful study of the problem with emphasis on the real reasons why college candidates shy away from the mineral industries, and what should be done to correct the situation. Agency? Perhaps National Coal, the Society of Mining Engineers, the American Mining Congress, or a joint operation by all organizations with a stake in the progress of the coal industry.

Prevention Benefits

HOW MUCH is proper preventive maintenance worth? There is an answer for every property and type of unit. As an example, with half a mechanic and a lunch and travel time of 60 min, actual time available for production, with mechanical and electrical delays of 15%, might be 357 min. What might happen if the section was assigned a fulltime mechanic, and the necessary supplementary steps were taken? If delays were cut to 10% in our example unit

working time would be increased 23 min per shift and unit output probably 25 or more tons, meaning at least \$100 more coal for another half day's wages plus the normal per-ton supply, power and similar costs.

Anyway you look at it the right maintenance setup permits the maximum output per unit and in turn the minimum in production cost. The answer is research and experimentation to evolve such a setup.



DELIVERY and boiler areas are parts of modern coal installation at new fabric finishing plant, Carlisle Finishing Co., Carlisle, S. C. Thousands more like Carlisle could be sold on coal's advantages if they knew the story.

Expanded market research needed in . . .

Planning for Growth in the Industrial and Commercial Market

By kicking off a huge market survey on the industrial and commercial market, Bituminous Coal Institute aims (1) to capitalize on a prime opportunity for tonnage growth and (2) to stem the grim prospect of continued sales erosion.

By W. A. Raleigh, Jr.,
Associate Editor, *Coal Age*

LOOK FOR Bituminous Coal Institute to lead a drive in 1960 for expanding market research and promotion in the general industrial and commercial market. The drive will focus on getting full industry cooperation in completing a market survey already underway. When completed, the survey will give information on this "mystery market" which has never before been available to coal. It will provide one of the most detailed, comprehensive breakdowns of sales potentials in a single market ever developed by any industry.

BCI is now compiling data cards on some 12,000 manufacturing establish-

ments which burn annually an estimated 300 million tons of coal and coal-equivalent. Each data card will provide the plant's name, address and a rough estimate of its fuel needs. Plans call for preparing questionnaires aimed at extending and refining this data: i.e., at finding out what fuels are used and in what quantities, the type and condition of boiler equipment, etc.

"Getting company cooperation and the manpower to complete the survey are the major problems," states Carroll Hardy, BCI's managing director. The manpower problem, it is hoped, will be solved by having company salesmen tackle the job of filling out the questionnaires. Salesmen from each participating company would be asked to survey their

present customers. They would also be asked to check a fair share of plants using competitive fuels in their marketing territories.

Fulfillment of the plan for distributing questionnaires hinges primarily on whether companies will endorse and push the survey project. To gain this cooperation from a maximum number of companies, BCI must break down two apparently formidable barriers. One barrier is producers' inbred opposition to releasing customer lists. BCI will need these to give each company questionnaires on plants it now serves and thus avoid intrusion by an industry-sponsored activity on "captive" customers. Another barrier is widespread reluctance to put salesmen on what many sales executives consider "nonproductive" calls to oil- and gas-burning plants. Both barriers can be overcome, BCI officials believe, if companies will recognize the package opportunity to solidify existing and develop new business.

Behind BCI's drive to upgrade market research and promotion in the general industrial and commercial

market are these three main factors:

1. An opportunity for tonnage growth exceeded only in the utility market.

2. The lack of market data essential to that growth.

3. Continued erosion of sales through losses to gas and oil.

Coal's present share of the on- and off-track industrial and commercial market is put at 120 million tons;

those of gas and oil, respectively, at 120 and 60 million tons of coal-equivalent. If the modern coal-burning story were adequately merchandised to all customers and prospects in this market, industry analysts estimate coal would capture 25 to 50% of the competitive fuels' share, or 45 to 90 million tons.

But where does coal stand in knowledge essential to achieve this

growth? There are a few bright spots on the horizon.

In forming BCI Oct. 1, 1956, coal recognized the need to mobilize for total selling (*Coal Age*, January, 1957, p 54). Since then BCI has more than won its spurs in showing how engineering data and service, spearheaded by a field staff of 19 men, can contribute to market development (see Carroll Hardy state-

R_x for Growth . . . A New Sales Approach

A MAJOR OVERHAUL in merchandising approach to the industrial and commercial market is urgently needed if coal is to capitalize on its opportunity in that market and stem the grim prospect of continued sales erosion. A *Coal Age* fact-and-opinion roundup from those close to the overall marketing picture in this field shows why:

- With some few exceptions, including those companies now working closely with BCI, the individual coal producer's knowledge of the market is confined to his own list of customers. He has had neither the factual market data nor the inclination for setting up a campaign to sell his product to competitive fuel-burning plants.

- Oil and gas suppliers and equipment manufacturers have focused their selling campaigns on uprooting coal's entrenchment in this market. These campaigns have paid off. But, in most cases, the payoff has not been due to superior burning equipment or to any greater merits competitive fuels offer in price and Btu value. Instead, it has resulted almost entirely from coal's failure to defend and promote its interests.

- The coal industry spends about \$50 million annually on selling coal but little of this is directed toward market analysis and promotion. Companies are still selling against each other—not against oil and gas. In a typical situation where there may be three coal- and seven competitive fuel-burning plants in an area, coal salesmen customarily call only on the three using coal. The net result is that each company is scrambling to hold its share of a dwindling market.

- There is practically no market research among coal companies. This is largely due to the fact that the industry is undergoing metamorphosis from family-owned to publicly-owned companies and from family to professional management. Scientific market research is a function of professional marketing management. And this talent is scarce in coal because top executives normally have not come up from the sales ranks.

- Even among those companies which do carry on market research, it is rarely recognized as a distinct department or activity. Where practiced, it is limited in scope to one-time reports from consulting firms, to piecemeal information from sales records and other miscellaneous company activities, or to

outside-industry energy forecasts which are insensitive to year-by-year changes in fuel supplies, prices, and cyclical or emergency factors.

- The industry has relied too much on its price advantages. The total fuel package must be sold; existing customers and prospects must be made aware of the modern coal story. Price advantages can easily be lost if consumers are inadequately informed on new equipment, boiler capacities and efficiencies, maintenance needs, etc. Competitors frequently avoid direct fuel-cost comparisons and cite data favorable only to their fuel.

- There is an appalling lack of knowledge on the condition of coal-burning boilers in existing installations. The big danger here is that most installations are vulnerable to a conversion story. The average age of boilers is now estimated at 19 yr and some are as much as 50 yr old. To compound the situation where the 50 yr-old, hand-fired boiler is involved, coal companies quite often resist the modern-equipment approach with this attitude: "Why are you trying to take my egg customer away?"

- Too often knowledge of an unhappy coal situation comes too late. Service and coals should be studied constantly to avoid dissatisfactions which set the stage for competitive fuels to move in. A common pitfall: Salesmen and purchasing agents frequently are more interested in price than in negotiating for coals suited to a particular plant's needs. Expensive coals do not always do the most efficient combustion job; conversely, cheap coals do not always lead to the lowest long-range fuel costs.

These comments from industry authorities leave little doubt of the need for major overhaul in coal's sales approach to the industrial and commercial market. Components of this overhaul might include:

1. Industry-wide cooperation in achieving full and continuous documentation of the market, as now planned by BCI.

2. A national program to encourage and guide formation of regionally-financed and operated coal-equipment sales and service agencies (*Coal Age*, August, 1959, p 68).

3. An industry program to promote BCI's plan for leasing coal-burning equipment as a method of overcoming the long-standing problem of lower costs for oil and gas equipment.

ment, p 75). Especially helpful have been a national advertising campaign and annual studies documenting price advantages for coal in its marketing territory.

Another boon to the cause has been the resumption by the USBM of quarterly and annual distribution statistics on bituminous shipments to general industry. These show tonnage and method of movement by districts of origin and states of destination.

Worthy of special note, too, *Key-stone Coal Buyers Manual*, a Coal Age affiliate, is now surveying about 600 companies, each of which consumes more than 10,000 tons of coal-equivalent per year. Objectives of the survey are to find out how many fuel-burning plants each company operates, the type and number of fuel-burning units used, and the quantity of current and future fuel requirements.

Overshadowing these bright spots, however, is a great vacuum in detailed knowledge of the total market. The panel (p 71) underscores how sadly deficient the industry as a whole is in knowing who its customers and prospects are, where they are, and what their equipment and service needs are. As a result, coal is leaving itself wide open to further inroads by competitive fuels.

Erosion of sales through losses to gas and oil has in fact been going on for years and is continuing. Take the following long-range look, for example, at coal consumption by "other manufacturing and mining industries," the USBM-defined category which in 1958 made up about two-thirds of the total industrial and commercial market:

	Annual Average, Thousand Net Tons
1947-49.....	110,206
1950-52.....	97,563
1953-55.....	87,295
1956-58.....	87,292
1959 Est.*.....	72,636

*Based on estimates for 1st 7 mo.

At best, the pace in erosion of sales, as shown above was temporarily arrested in the 1956-58 period; at worst, it could be made to look more severe in terms of industrial expansion over the past 12 yr, or in terms of consecutive drops from 87.2 million tons in 1956 to 81.4 and an estimated 72.6 million tons in 1958 and 1959, respectively.

The upshot of it all? A time for

decision is here for coal. Companies must choose between the following two courses:

1. Give full backing to industry market research and promotion programs aimed at strengthening and extending coal's position in the total industrial and commercial market.

2. Scramble among each other for existing business and watch continued erosion of sales, perhaps lead-

ing to major decline, through losses to gas and oil.

Choosing between these courses should be no problem if individual producers will lift traditional barriers to industry selling efforts, if they will recognize that their self-interests will be served best by uniting in the common battle against competitive fuels; if they will heed the following statements made by company and association executives qualified to speak authoritatively on the subject.

Detailed Market Analysis Protects, Builds Sales



W. W. Bayfield,
executive vice
president,
American Coal
Sales Association

If we do not know who our potential customers are, where they are, what their fuel problems are, the kind, age and condition of their equipment, we cannot analyze and plan promotion activities.

I firmly believe that our industry needs a market research program in greater detail and of greater intensity than was ever conducted by any industry. This important tool of modern marketing has been all but ignored by the coal industry. . . .

I propose, therefore, that we should immediately undertake a survey of every on-track plant now using either fuel oil or gas. We should endeavor to obtain the same type of information on these companies that any good sales company maintains on present consumers of bituminous coal. This is a monumental undertaking. But if we do not know who our potential customers are, where they are, what their fuel problems are, the kind, age and condition of their equipment, we cannot analyze and plan promotion activities.

This job can be done most effectively and most economically for BCI by the territory salesmen of coal companies. It needs careful planning and the active support and cooperation of all sales executives and their personnel. The job can be done and I believe it must be done. When completed, we will have the most comprehensive and complete information ever gathered by one industry on its potential market.

A careful analysis of that information will enable us to classify these prospects properly. For example, the first category would be made up of prospects where the advantages of burning coal could be most clearly demonstrated. The second would include those cases where the benefits are less marked. The last group would consist of cases where our cause is hopeless or almost so under existing conditions.

With our prospects thus classified, we can then plan and conduct our promotional activities so as to devote our time and resources in the most effective manner. BCI field men and company salesmen can be routed to accomplish this on the same facts. The frequency of calls can be adjusted to the potential of the prospect and where hope of success is greatest.

A similar survey of institutional, commercial and small industrial plants should also be made. These accounts are served by retail coal merchants, so the job should be done by them with help from BCI. This is potentially a market for over 60 million tons a year. It is a market in which coal is the most economic fuel in all but a small segment of our country. Yet it is the market in which our promotional activities have been least successful.

Defining the Market . . .

THE GENERAL INDUSTRIAL and commercial market is sometimes called the "mystery market" or "the forgotten one-third of coal sales." Reason for the tags: the market is a polyglot, miscellaneous group of outlets with no clearly defined identity in terms of usable sales planning data or statistical reporting services. Lack of identity is further compounded by attempts to identify the group, for example, as "other industrials," "general industry," the "on- and off-track industrial and commercial market," "industrial steam," and the "intermediate market." None of these designations means quite the same in tonnage shipped by producers or used by consumers.

BCI prefers to call its target the "on- and off-track industrial, commercial and institutional market." In terms of USBM statistical reports on consumption, the definition includes bituminous use by "cement mills," "other mining and manufacturing industries" (excluding coke plants and steel mills); it also includes a sizable but undetermined percentage of "retail deliveries" to commercial establishments, institutions and small industrial plants. Because these statistical groups provide no clear-cut distinction between commercial, institutional and industrial shipments, nor between on- and

off-track deliveries, BCI figures its jawbreaker-designation is—at least temporarily—most definitive.

BCI also clings to this designation because it is moving—as fast as its staff and industry support permits—toward defining and documenting the complete range of outlets involved.

A recent market survey showed there were some 36 types of commercial, small industrial and institutional accounts served through off-track or retail deliveries. Among the 383 retail dealers surveyed in 276 cities, the leading types of accounts included apartment buildings; schools and colleges; churches; stores; garages; manufacturers; florists and greenhouses; office buildings; hotels; dry cleaners; laundries; hospitals; clubs and lodges; warehouses; and dairies and creameries.

The Institute's planned survey of bituminous use by 12,000 manufacturing establishments will be based on 75 major industry groups classified by the U. S. Government's Standard Industrial Classification Manual. Within these groups, the 1954 Census of Manufacturers reported that 129 individual industries used a minimum of 100,000 tons of bituminous coal.

Leading the major industry groups in total-fuel and bituminous consumption were the following:

Industry Group	Ranked by Total Bituminous Cons.	Ranked by Fuel Cons.*
Pulp, paper & paperboard.	1	4
Cement, structural clay products.	2	5
Industrial organic chemicals.	3	6
Blast furnace, steel mill & iron & steel foundry products.	4	1
Petroleum and coal products.	5	2
Motor vehicles & equipment.	6	10
Cotton, rayon & rel. products.	7	8
Dairy products.	8	9
Rubber products.	9	15
Misc. food preparations.	10	13
Concrete, gypsum mineral wool & stone prod., lime.	11	12
Beverages.	12	21
Meat products.	13	14
Sugar, confectionary & rel. prod.	14	19
Engines; turbines; farm mch., constr., mining & oil equip.	15	20
Misc. chemical prod.	16	22

*Includes bituminous and bituminous-equivalent for anthracite, coke, oil, gas and electrical energy purchased.

More Market Data A Basic Survival Need



Everett H. LaRue,
vice president,
Princess Coal
Sales Co.

To meet gas and oil on a strong footing in the industrial and commercial market, we must know definitely its status . . . we therefore intend to cooperate fully with BCI in its current market survey.

Competition within the coal industry is intensely severe, but this

condition is exceeded by the competition of gas and oil in the fuel market. This double-edged market situation can be expected to require a vigorous coal selling effort for the next several years. Successful selling techniques must be as sharp as the competition. Hard selling or strongly aggressive selling, however, will not necessarily do the job. Increasingly important will be a competent direction and planning of sales effort, and an improvement of sales technique.

An important instrument of planning available to most coal companies is the sizable amount of production and market data compiled by a half dozen sources that serve the industry, such as the National Coal Association and Appalachian Coals, Inc. Obviously, this type of data is no better than the use to which the companies put it. Princess Coal Sales Co. has long been a student of this type of information and has tried to use it in a means that would per-

mit us to be informed and stay abreast of the dynamics in the coal market. Many elements needed for sales planning are to be found in this information. Market potential, location and size of sales territories, sales quotas, product size and quality requirements, realization and profit expectancies can be evaluated.

As excellent as this information is, and as voluminous as it is, Princess Coal Sales has often felt the need for further information not offered by these data. As an example, we recently concluded that we had to know in more detail certain aspects of one of our vital market areas. We decided to develop an investigative program of our own, employing several college students who, incidentally, were majoring in marketing. We devised a house-to-house survey which resulted in our having approximately 5,000 interviews on the subject of a householder's general attitude toward his use of coal, and in particular to-

ward our coal. The results of the survey were so very enlightening that we were able to take the facts derived and do a job of planning and forecasting for our domestic sales in a manner that would have been impossible otherwise. We became convinced from this experience that penetrating investigation has no substitute.

The current Bituminous Coal Institute survey is an example of a vital research program which will benefit the coal industry. As is known, the important off-track industrial and commercial market presents many unknown factors which must be checked out sufficiently well for us to assess this market. To meet gas and oil on a strong footing in this market we must know definitely its status. We, therefore, are interested and intend to cooperate fully with BCI as they set out on this survey. Further, we feel that this is a part of an overall market research effort that the industry should be interested in and support it.

All companies and all coal sales agencies should constantly seek a better means to market their products. The coal industry has suffered from too much distress selling which, of course, is a process not of selling but of giving away. Coal is confronted with many basic problems of survival. One of the greatest of these is the serious necessity for coal to improve its strength in the fuel market place.

Broad, Scientific Approach Key to Effective Research



C. R. Mabley Jr.,
president,
Island Creek Coal
Sales Co.

If market research is to contribute to development of the general industrial market, it must be applied to broad programs of industry-wide organizations.

Large industrial consumers are quite well known to the industry and

potentials for coal usage in these installations have been rather accurately analyzed by sales-minded coal producers for many years . . . Few coal companies, however, maintain completely staffed market-research departments. In the past, most market surveys which have been undertaken have been designed to obtain special information on some specific segment of the market of special interest to the company in question so that these surveys have lacked both the broadness of scope and the scientific approach which is characteristic of good research procedure.

Therefore, if market research is to contribute materially to the development of the general industrial market, it must be applied to industry-wide programs having such a broad scope of interest as to justify trained research personnel capable of establishing specific research programs and capable of providing adequate training for the field researchers who, in this instance, would in all probability be the coal salesmen themselves.

It is conceivable, for example, that interested companies could send supervisors to conferences conducted by the industry organization to receive indoctrination in the program and in basic interviewing techniques. They, in turn, could supervise the field efforts of their own salesmen and process market data for overall industry compilation. In this way, significant industry-wide research projects could be carried out continually without the very costly services of professional market research companies. This, however, presupposes the cooperation of all elements of the industry which, unfortunately, is not always present.

If it were possible to get full industry support for such a program one immediate and fruitful area of study would be the 30 million-ton retail-dealer market. Probably less is known about this market than any other market of the coal industry. A very large percentage of the tonnage moving into this market is off-track commercial. The actual commercial tonnage involved and the breakdown by types of consumers is, for the most part, a mystery.

It is unlikely that a knowledge of this very profitable market can be obtained without the close cooperation of retail dealers. They alone know exactly where the commercial tonnage is used. Obtaining this type

of data becomes a definite market research function. A study designed to yield full information regarding the nature of this off-track business would permit both individual producers and promotional organizations to aid dealers in holding existing tonnage, developing additional tonnage in new installations, and recovering business already lost to competitive fuels.

Independent Attitude A Major Roadblock



W. A. Barringer,
vice-president—
sales,
North American
Coal Corp.

More market research would be most useful but increased activity is extremely doubtful because of the industry's lack of cooperation with confidential information.

The activities of the Economics and Statistics Committee of the National Coal Association are a beginning to industry market-research efforts. Full and complete cooperation on the basis of a separate agency to disseminate information without identifying the companies involved would be a tremendous asset. But an historic independent attitude and lack of cooperation with anything approaching confidential information on the part of the coal industry would seem to make the hope of increased activity in this direction extremely doubtful.

Increased activity, however, would be most helpful. The benefits of market research in the general industry market are twofold. It pinpoints prospects and customers and, at the same time, enables one to grasp the full scope of the market. This knowledge is very useful in current sales and future planning, as well as

strategic placement and manpower requirements.

It has been extremely difficult to pinpoint actual competitive conditions between coals on a broad market basis to apply to the individual business. But market research has been of considerable benefit in discerning the competitive conditions between coal and other fuels, both in considering the overall market and with individual businesses.

BCI Can Do the Job— With Full Cooperation



R. L. Ireland,
chairman,
executive committee,
Consolidation Coal
Co., and president,
Bituminous Coal
Institute

We have got to have support and help from retailers and the sales arm of the coal industry.

We are spending more money than any other [NCA] department trying to save and build the industrial market, on- and off-track. It is my considered judgment, that the money has been well spent, and that the project is well worth the effort that all have been putting into it . . .

For one thing, there are many specific illustrations of where it was said, "it can't be done," but BCI has done it. We either kept coal or put coal in competition with oil and gas. More efforts must be made along the same line and we'll do more of it.

When we talk of the off-track market, we're talking about the plus-buck business, and there's a lot of it available if we work hard enough at it. We have got to have the co-operation of the retail industry. We're getting it slowly, just as it's been slow getting the producers themselves to appreciate that this effort of BCI is a worthwhile project.

All I would ask is that [top management] talk to sales managers and tell them: "Don't you think you had

better get on the ball a little bit more and do a little more cooperating with the BCI outfit?" The staff we have—[19] field men over the entire United States—can't do the job alone. We have got to have support and help from the sales arm of the coal industry to do the job we're spending its money on.

I therefore urge again, please take this to heart—please stress the need for the sales arm of the industry to participate even more than it is now doing. I am sure that those companies which have their men working in cooperation with the staff of BCI are finding it well worth their while to do so. I'm equally sure that those which have hesitated up to now are making a serious mistake.

Win by Fighting or Lose by Default?



Carroll F. Hardy,
managing director,
Bituminous Coal
Institute

The only way to increase coal use in its natural market, the coal-burning states, is to get out and sell the present advantages of coal instead of depending on the future disappearance of gas and oil.

BCI is determined to prevent the industrial and commercial market from being lost by default. This market is not captive to coal as a few people seem to think. Either we get out and work on it or we lose it. If we do not bring the consumer image of coal up to date, coal will not even be considered. . . .

If a consumer service can have an image, here is one for BCI. The theme is service to the consumer to get him on coal and make sure he stays satisfied with coal through the best utilization. Satisfied commercial and industrial consumers are the only

guarantee that nearly a third of the coal industry's total tonnage will continue to have some place to go.

Even more important, BCI is working to increase coal use in its natural market, the coal burning states, by proving that gas and oil don't belong there. The only way to do this is to get out and sell the present advantages of coal instead of depending on the future disappearance of gas and oil.

Pertinent is an evaluation of BCI activities. The short-term results of the institute's program are: 5,600 projects initiated in 2½ yr (10/1/56 to 4/1/59), of which 1,400 were closed to coal, and 1,200 closed—temporarily—to other fuels. We say temporarily because many of these plants will be prime targets for coal later, as our experience has shown. There are 3,000 projects pending decision. Some may never be decided but they are not forgotten. . . .

It is estimated that some 120 million tons of coal are sold in BCI's primary target area, commercial, industrial and institutional plants, both on and off track. The potential for coal is much greater, considering that gas use in this market is about 120 million tons equivalent and oil use adds another 60 million tons equivalent. So, rather than a market of 120 million tons, BCI is shooting at a potential of 300 million tons of coal or tons equivalent, not counting the work being done on utility tonnage. So far, BCI has not entered the fields of by-product and export coal to any extent.

BCI has contacted directly plants in the field consuming 40 million tons or tons equivalent. [Among the 19 million tons or tons equivalent where decisions have been made] the score in this highly competitive market is nearly five to one in favor of coal; that is, the BCI effort gained or retained 15.2 million tons against a loss of only 3.8 million tons. . . .

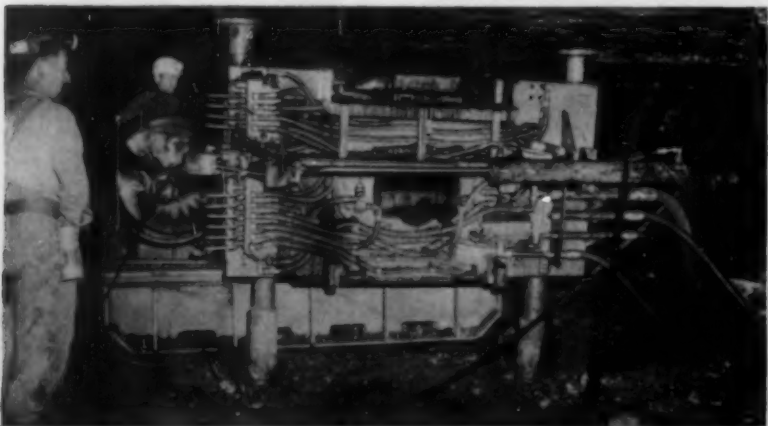
Thus, BCI has produced concrete results to justify its existence. It has set up a pattern for successful coal promotion. Here is an organization that works—the only need is more of the same—more industry support in money and manpower, more co-operative action from coal men on every level, more individual effort to win projects for coal, more interest in the future of coal as well as in immediate tonnage.



UNDERGROUND AUGER bores 34-in holes to depth of 100 ft at Wind Rock Coal & Coke Co., Oliver Springs, Tenn. Self-moving unit is hydraulically powered from separate unit, has 5-ft auger sections, four leveling jacks and two anchor jacks.



POWER UNIT, connected to auger unit by hydraulic hoses, also is self-moving. Unit has two 50-hp motors, controls and 250-gal tank of hydraulic oil.



AUGER CONTROLS, except feed and rotation, are mounted at left rear of machine. Two men operate auger, including moving and setting at new site.

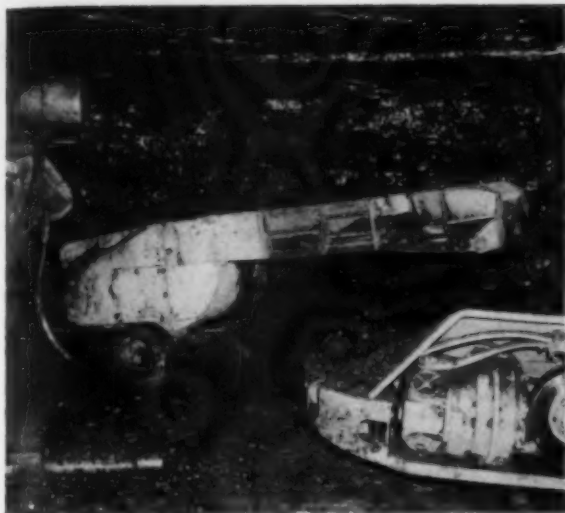
Underground

Specially designed 34-in auger recovers clean coal from seam split by thick, tough parting. Company set 100 tons per shift as goal for three-man crew at Tennessee mine.

HIGH on a Tennessee mountain, 10 twisting miles from Oliver Springs, Wind Rock Coal & Coke Co. is pioneering a new underground auger. Underground recovery of thin seams that could not be mined profitably otherwise and selective mining of thicker seams with thick, tough partings are two important reasons why Wind Rock is pulling out all the stops to perfect the underground augering technique.

Today the company uses a specially designed Salem 34-in auger to recover coal from a split of the Dean seam. Employing a three-man crew to operate the auger and transport the coal to mine cars, management hopes to produce an average of 100 tons per shift. Although the company expects to reach that production goal in the not-too-distant future, efforts now are being concentrated on training the crew in these important jobs:

1. Setting the drill properly so



TRANSFER CONVEYOR receives coal from short conveyor mounted on auger frame, delivers it to surge car.



SURGE CAR with remotely controlled conveyor makes possible continuous drilling while second car hauls coal.

Augering Today

holes can be drilled to the projected 100-ft depth.

2. Moving and resetting at a new hole in a minimum of time.

3. Learning how to operate the drill most efficiently.

As mine development in the Dean seam advanced into coal with increasingly thicker and harder rock parting, management intensified its study of how to maintain or increase worker productivity and at the same time mine the cleanest product possible. Keeping mining costs as low as possible is extremely important at Wind Rock since all of the company's output is sold on the highly competitive TVA market. One idea set forth by W. F. Hayden, vice president, during management discussions was underground augering. This method had interesting possibilities and, as a result, several auger manufacturers were called in to discuss the problem.

The Salem Tool Co. was actively engaged in designing an underground auger and two machines already had been fabricated and proven successful in anthracite mining. But these two machines were designed especially for drilling 24-in boreholes in preparation for blasting or for ventilation. Coal production was not considered as the primary objective with these anthracite machines. Nevertheless, success of these

special drills prompted Wind Rock management to ask Salem Tool engineers to design a higher-capacity unit to meet the conditions in the Dean seam.

Auger Design

The auger built for Wind Rock is hydraulically powered and has separate power and drilling units. The two components are connected by 50-ft lengths of hydraulic hose and are self moving. Greater flexibility in moving and setting as well as minimum size are possible with the separate power and augering units.

The power unit measures 9x7x4 ft and weighs 8½ tons. Its frame carries two 50-hp permissible DC motors, hydraulic pumps and a 250-gal tank of hydraulic oil. Hydraulic power is transmitted to the drilling unit through the 50-ft sections of hose.

All movements of the power unit and drilling unit receive power from this hydraulic system. The power unit is self moving on two hydraulic skids and has four hydraulic jacks for leveling. Each skid and each jack operates independently.

The drilling unit measures 11x7x4 ft and weighs 9½ tons. It also is self moving on two skids and has four leveling jacks. The skids are 7 ft long,

12 in wide and have a 36-in travel. Once the unit is positioned for drilling it is secured in place by two roof jacks at the rear of the unit. These jacks extend a maximum of 36 in.

Wind Rock's auger is fitted with a non-rotating auger-head barrel which has inside it an Austin 6½-in pilot bit and eight carbide bits distributed on three equally spaced arms. Rotation speed may be varied from 0 to 37 rpm, but Wind Rock finds that best results are obtained when the head turns at maximum speed. Two runners on the outside of the barrel control direction of the head once it is positioned in the coal. Auger sections are 5 ft long with 4-in-square tapered shanks. Sections are joined by pins.

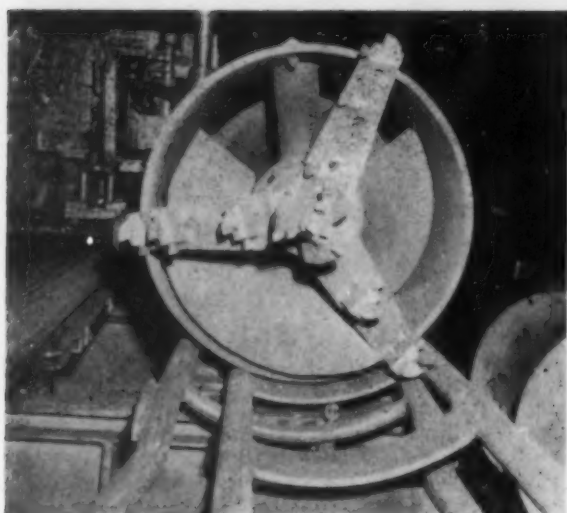
Operating the Auger

Two men operate the auger and a third man drives a shuttle car between the auger surge car and the loading ramp.

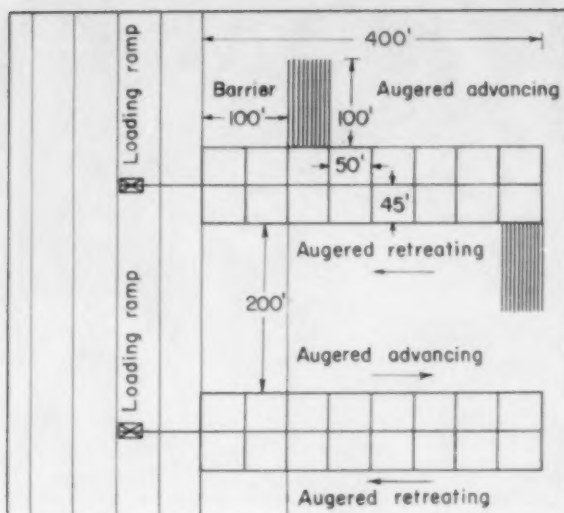
Wind Rock has two cutting heads and 19 5-ft auger sections. The full string of augers and a cutting head make it possible to drill holes 100 ft deep.

Most of the drilling unit's controls are mounted at the left rear of the machine. But the feed and rotation controls are conveniently located further forward and may be operated from either side of the machine.

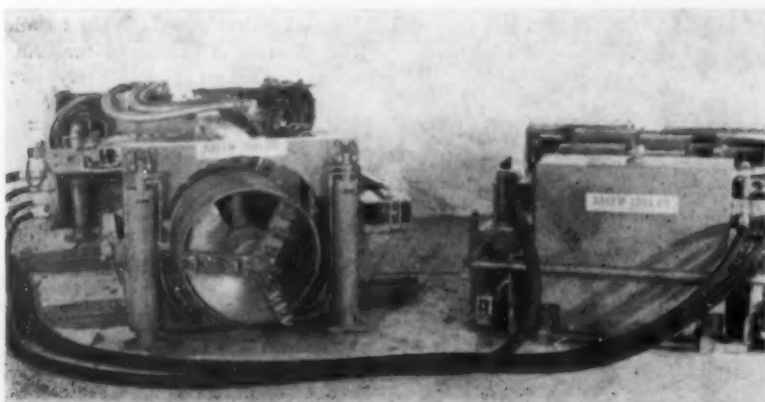
After a hole is completed, the



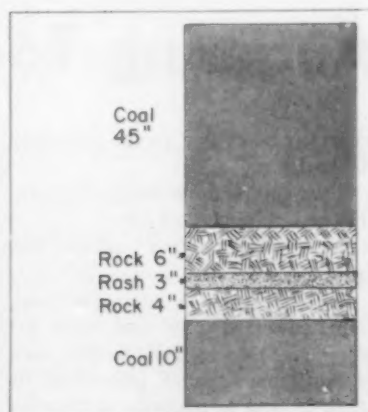
CUTTING HEAD has pilot bit and three equally spaced arms with carbide cutting bits. Head rests on cradle on skids.



AUGERING PLAN calls for drilling to 100-ft depth advancing on one side, retreating on the other.



ORIGINAL AUGER for Wind Rock looked like this. Alterations to meet changing conditions include higher skids and short conveyor on frame.



TYPICAL coal section in underground auger mining section.

anchoring and leveling jacks are released and the drilling unit lowered to the two moving skids. As soon as it is in position for drilling the next hole, the second cutting head is rolled into place.

As the cutting head advances, auger sections are recovered from the previously drilled hole and added in the new hole. The sections are pulled out as needed by a cable and hook powered by a hydraulic jack. The recovered section is pulled onto a cradle which is mounted on the machine skids. After being disconnected, the section is ready to be rolled into position in front of the new hole.

Both the drilling and power units can be transported on mine track. Two specially designed 42-in gage trucks are available to simplify moving.

The Augering Plan

Preparation for augering requires three 14-ft headings on 45-ft centers to be driven 400 ft deep off a five-heading panel entry. Conventional off-track equipment handles this job.

Augering starts 100 ft from the panel entry and advances along one side to the full depth of the 400-ft-deep entry. The auger then is moved to the opposite side of the entry where augering is done on retreat to a point which is opposite the starting point.

When operating 400-ft-deep auger entries are developed and drilled until the entire panel is mined to the 100-ft barrier. Wind Rock plans to recover the 100-ft barrier with the auger.

Auger coal drops onto a short chain

conveyor which is mounted on the auger frame. This unit discharges onto a special wheel-mounted Long Piggyback conveyor which transfers the coal to a 32E shuttle car. This car serves as a surge hopper. A second 6SC car transports the coal from the surge car to Sanford-Day 4-ton dropbottom mine cars at the loading ramp.

The short chain conveyor and the Piggyback operate from the same pushbutton. The surge car's conveyor chain also is operated remotely by pushbutton.

When operating in clean coal, the auger takes an average of 1 hr to drill a 100-ft hole. The two men have drilled 100 ft and moved to a new setup in 53 min.

It takes the men an average of 20 sec to pull back the carriage and get

Mobile Tournatractor cleans-up around
7 widely-separated shovels . . .

2 Cleans-up pit-floor after blasting . . .



3 Levels and compacts stockpiles . . .



How this large limestone quarry saves on tractor clean-up costs



4 Handles clean-up at waste dumps . . .



5 Cleans-up around crusher-grizzly
as well as polices entire plant area . . .



6 Maintains haul roads as it "runs"
from one job to the next . . .

At Texas, Maryland, the Harry T. Campbell Sons' Corporation operates one of the largest limestone quarries in the eastern states. With a half-dozen shovels, and numerous stockpiles over a considerable area, the firm once kept 2 crawler tractors busy on maintenance and clean-up work. But like all track-type tractors, the rigs spent about as much time just going from job-to-job as they did working.

"We bought Tournatractors to do the work of a crawler tractor whose main job was to clean-up the quarry floors," says Superintendent Eddie Reichert. "It really moves around our pit and does a grand job."

Owners of the Harry T. Campbell Corp. agree. "It's Tournatractor's speed that does the trick," says Mr. Campbell . . . "Tournatractor completes the clean-up job so fast, that it is available to do many other jobs throughout the quarry operation. In addition this rubber-tired tractor requires less maintenance than any track-type tractor."

Illustrated and described here are some of the jobs handled by this "go-anywhere", rubber-tired LW tractor during a single work shift.

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LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Augering (Continued)

ready to add a new auger section. And it takes them 15 sec to attach the new auger section. Penetration rate in clean coal has been clocked at 5 ft in 2 min.

Each 100-ft hole yields about 23 tons of coal. Management's production goal is five or six holes per shift and two-shift operation. Recovery is about 50% when 6 in of solid coal is left between holes and they are drilled to the full 100-ft depth.

Solving Augering Problems

Wind Rock in cooperation with the manufacturer has made several changes to improve over-all performance since the original installation in September, 1958. Some of the changes were made to simplify auger operation. Others were made to adapt the machine to changing conditions.

For example, a chain conveyor was originally installed along the rib to catch coal from the auger and trans-

fer it to mine cars. This conveyor arrangement handicapped auger operation because the machine could not be set up as close to the rib as desirable. As a consequence, the company experienced some difficulty in starting holes in offsets in the rib.

To solve this problem, two changes were made. First a short chain conveyor was mounted on the auger frame. Then a wheel-mounted modified Piggyback conveyor was added to receive the coal from the short conveyor and transfer it to a surge car. A second shuttle car was added to carry coal to mine cars. The two new conveyors made it possible to set the auger closer to the rib. Both conveyors operate remotely from the same pushbutton. A remote-control pushbutton for the shuttle-car conveyor chain also was added. Now the auger crew can control all units from one position.

To simplify starting a new hole in an offset as well as provide support for the auger head, the cutting-head barrel was extended.

To speed moving and resetting, high skids were added and sleeves were placed over the four leveling jacks. Thus the auger, which operates above partings in the coal seams, needs to be lowered and raised a minimum distance when moving to a new site.

If the underground auger lives up to expectations, the company envisions not only stepped-up auger production in the Dean seam but also the possibility of profitable recovery of the Wind Rock and Pee Wee seams. The Wind Rock coal averages 4 ft in thickness and is good quality. But past mining proved difficult because of the heaving floor. The Pee Wee coal is 36 in thick and is an excellent domestic coal but it is overlain by 24 to 26 in of drawrock which cannot be held. The ability to economically recover these two coals not only would add considerably to the company's recoverable reserves but also would have the effect of putting the company in position to broaden its markets.


Conventional Mining

Wind Rock employs conventional off-track equipment to selectively mine the Dean seam, which contains 10 to 12% inherent ash. Management notes also that the coal is difficult to wash and the elaborate facilities necessary to fully prepare it are not justified by the low realization on the utility market.

Section equipment, operated by a nine-man crew, includes a Joy 11-RU cutter with 9-ft bar, 14-BU loader, two 6-SC shuttle cars, Fletcher roof bolter and Schroeder or Jeffrey hydraulic coal drill.

When the company first opened the Dean seam all workings were in 5½ ft clean coal. As the clean coal became exhausted workings advanced into coal with 6 to 8 in of partings. The impurity gradually became thicker and harder and cutting became more difficult, production decreased and cost rose correspondingly. It was this increase that led to the purchase of the auger as a method of cutting costs.

When roof conditions permit, a skeleton crew employing a Goodman 665 loader and 6SC shuttle car follows behind the auger and recovers the coal left between the auger holes and the chain pillars. A crew of four men loaded 160 tons by using this method.




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All LeTourneau-Westinghouse 80, 115, 123, and 160 hp Adams graders have constant-mesh transmission as standard, with 8 forward and 4 reverse speeds. In addition, 3 optional creeper speeds provide extra lugging power for turning up rocky sub-surfaces and for greater grading accuracy. Choice of 15 gear ratios give you the balance of power and speed to handle every grading job... in any material... at top efficiency.

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Adams' blade mechanism is firmly mounted on a heavy-duty circle for chatter-free operation. Strong T-shaped drawbar gives L-W grader firm circle support for accurate blade in any material.

Blade positioning is fast... it swings maximum arc from deep ditch-cut to high bank-cut in less than a minute. Moldboard turns 360° — clockwise or counter clockwise — provides quick change from any forward work position, to desired angle for reverse ditching and grading.

Low operating costs

All gears operate on anti-friction bearings — for less wear, easier operation. Automatic braking on



Powerful L-W Adams 660 — at large open-pit mine in Arizona — patrols busy haul roads 24 hr a day, 6 days a week. Grader goes wherever needed (at speeds to 26 mph) to fill ruts, level washboard, clear debris dropped by overloaded haulers and improve drainage.

transmission, when hydraulic brakes are applied to wheels, gives safer operation and less maintenance. And because L-W power-control clutches shift on ball bearings, you have easier, smoother, safer controls... assuring accuracy, speed, and performance with minimum upkeep.

Keeps busy all year

Between regular assignments, your LeTourneau-Westinghouse grader need not sit idle. With available attachments, such as Jebco Elegrader,

bulldozer blade, scarifier, snow plow and wing, you can keep this grader busy on your property the year round. Also, grader's high travel speeds (to 26 mph) permit the profitable handling of jobs for adjoining pits. There are 7 Adams models — 67 to 190 hp. Your choice of GM or Cummins engines on 6 larger models. 190 and 145-hp POWER-Flow[®] models have torque-converter drive... will do more work faster than any other graders on the market. Call or write for a demonstration today!

[†]Trademark G-1874-MQ-1



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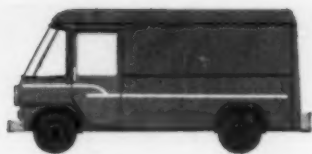
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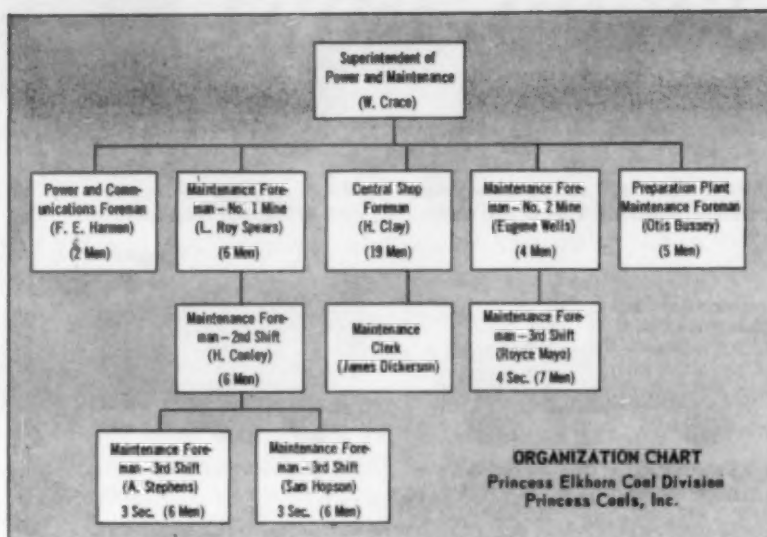


STAKE bodies from 7 $\frac{1}{4}$ ' to 14' are built by Dodge on models to 19,500 lbs. G.V.W.



TANDEM units provide top hauling strength for dump and other extra-rugged operations.





Preventive Maintenance: A Positive Approach

Here's how Princess Coals re-organized its maintenance program to eliminate or reduce lost man-hours, idle equipment time and excessive supply costs. Results? Substantial savings in over-all operating costs.

By Daniel Jackson Jr., Assistant Editor, *Coal Age*

WITH A SUCCESSFUL NEW PLAN, two divisions of Princess Coals, Inc., have demonstrated the value of preventive measures in maintenance of mine equipment. At Princess Elkhorn Coal Div., David, Ky., and at Powellton Coal Div., Mallory, W. Va., the forces of cause and effect in maintenance have been analyzed and brought under control to an extent that is probably unexcelled in the coal industry. The causes of lost man-hours, idle equipment and excessive supply costs have been removed and reduced to achieve substantial savings.

The program started about 3 yr ago. After experiencing a period of maintenance delays that did not seem to show any tendency to decline, William Crawford, vice presi-

dent of operations, and his two divisional general managers, Court T. Dahlin, of Princess Elkhorn, and Adler E. Spotte, of Powellton, decided to develop a more vigorous and aggressive pattern of control. This determination stemmed from the evermore-apparent fact that only an efficient company can survive in today's competitive market.

Princess Elkhorn produced 1,155,175 tons in 1958 from Mines No. 1 and 2. Mine No. 1 has six producing sections and No. 2 has three. All sections are completely mechanized. Average height of the Elkhorn No. 3 seam is 30 in. Coal is processed at individual preparation plants.

Powellton's 1958 production was 1,073,920 tons and was produced at three different mines. Coal from the 42-in Powellton seam and the 46-in Cedar Grove seam is mined with conventional equipment and processed in a twin preparation plant.

Preparing for the Program

Actually, in many respects the new program was an extension of practices that had long been followed by the two divisions. The maintenance and industrial engineering departments had for some time been concentrating on the development of better maintenance methods. The new plan, however, was to be constructed around a concept that was a bit different for Princess Coals. The program was to be called a "Unit-Assembly Changeout" and was to provide for a schedule of mine equipment unit change based on a standard of operating life expectancy of each unit. In effect, the plan put to work the old ideas expressed by the axioms which recommend an ounce of prevention or a stitch in time.

Maintenance Training — Early it was learned that any maintenance endeavor would be successful only if there was enough skilled maintenance manpower to perform the class of repair work a good maintenance program required. Consequently, before any real start was made in developing the details of the new maintenance plan, a training program for maintenance personnel was begun.

Classes were taught by foremen and, periodically, some mining equipment manufacturers furnished special instructors, as did oil and bearing companies on lubrication and bearing maintenance. A nearby vocational school was asked to offer a course in mine mechanical maintenance. The full course consisted of 3,200 hr of shop practice and machine work, such as lathe, milling machine, drill press, shaper, welding, motor winding, panel boards and control wiring, blueprint reading, drafting and other related subjects. Many young men had just returned from war services and were looking for work. They were untrained but willing. They were glad to take this training under the GI Bill. Upon graduation Princess Coals and other companies hired these men as helper-trainees in maintenance.

To keep up to date experienced maintenance-department employees were encouraged to enroll for special training in welding, hydraulics, panel wiring and controls, and blueprint reading. Training classes on the job were also started. Two-hour classes

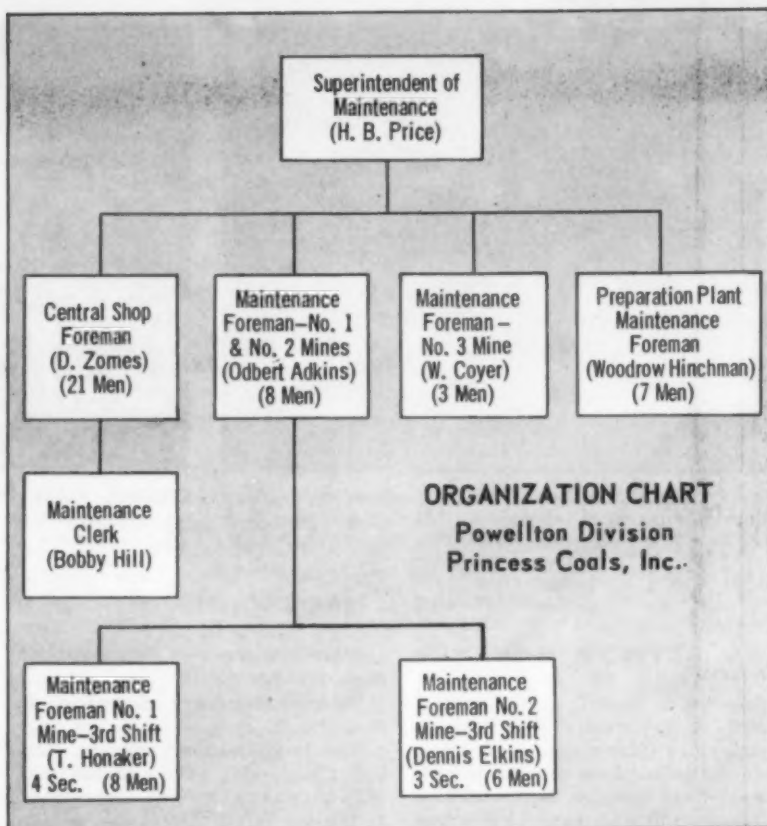
were held twice weekly for 10 wk. Refresher courses in hydraulics, panel wiring, lubrication, bearing maintenance and gear fits were taught. Question-and-answer discussions were held to teach the technique of trouble-shooting. The results of all of these efforts were most encouraging and helped to launch a successful maintenance program.

Maintenance Objective—The objective was to eliminate time-consuming major repairs and replacements. To ascertain the scope of the program several conferences were held to determine how many complete units on face equipment could be changed out underground. Heading up these discussions were the maintenance superintendent and the director of industrial engineering of each division: Walter Crace and Raymond Bradbury, of Princess Elkhorn; H. B. Price and Garland Altizer, of Powellton. Approximately 70 unit assemblies were decided upon. Most of these were on three types of equipment: loading machines, shuttle cars, and cutting machines.

The life expectancy or change cycle on all unit assemblies was set by the maintenance supervisors from records available and from experience. As experience dictates, schedules are revised both as to the units to be included and the frequency of changeouts. To furnish a foundation for the program, several additional unit assemblies were purchased. A well planned spare unit of supply is important.

Changeout Schedule

The heart of the program is the changeout schedule. Obviously, only if this schedule is accurate and practicable will the maintenance plan succeed. This phase requires experience and sound judgment on the part of maintenance personnel. If units were scheduled for changeout too often or before they yielded their maximum useful service, the cost would be too high. Conversely, if changeouts were too far apart the units would break down during production shifts, thereby rendering the program ineffective. A normal life expectancy had to be found for each unit. Initially, it was difficult in some instances to accurately estimate the useful life of a



unit and to establish permanent frequencies.

A Monthly Rescheduling—To locate weaknesses in the changeout schedule the industrial engineering department works closely with the maintenance department, not only in the changeout schedule but in all phases of the preventive-maintenance program. Each month the schedule of changeouts for the coming months is revised and updated.

This work is done at Princess Elkhorn by Raymond Bradbury and James Dickerson, maintenance clerk, and at Powellton by Garland Altizer and B. E. Hill, maintenance clerk. Rescheduling also insures equal distribution of the work load throughout the month so that the crews will not have more changeouts than they can handle.

In some instances the schedule has been extended or shortened to arrive at the best frequency. For ex-

Changeout Groundwork

Steps taken in organizing the unit-assembly changeout program at Princess Elkhorn and Powellton Coal Divs. were:

- I—Compile a complete equipment survey.
- II—Determine which components of each machine should be placed on the unit assembly changeout schedule.
- III—Establish standards for the actual useful life of each unit assembly.
- IV—Reorganize the maintenance department thoroughly, from the maintenance superintendent to the inside mechanic.
- V—Equip maintenance shops with necessary tools, work benches and supplies, and provide the necessary number of spare unit assemblies.
- VI—Provide control reports and records for the over-all plan.
- VII—Plan special maintenance projects.

Maintenance Ideas

MASTER CHANGEOUT SCHEDULE is updated daily to keep maintenance personnel informed so that they can plan their work in advance and make certain that spares are available.



SPECIAL WORK BENCHES are equipped with a complete set of spare parts to repair one unit. Shops at Powellton and Princess Elkhorn are furnished with these desk-type benches.

Controlling Changeout

THE REVISED MONTHLY SCHEDULE for unit-assembly changeout is posted on the central board in the central-shop maintenance office (photo above). The left side of the board contains cards with the names of the units. Each card lists the number of units in service (upper left), number of spare units available (lower left) and the frequency of change (right).

The small tags opposite the cards and under the months of the year are made up in four colors:

Red—unit due to be changed.
Green—unit has been changed.

White—emergency changeout at Mine No. 1.

Yellow—emergency changeout at Mine No. 2.

The large numbers on the tags indicate the day of the month that the unit is to be changed. The number at the top left indicates the section that the machine is on and the top right letter designates whether the right or left assembly is to be changed, i.e., the right or left traction motor on a loader, for example.

A list of the main assembly units included in the schedule is given elsewhere in this article along with the frequency of change for each unit.

ample, shuttle-car wheel units have been tested for 18, 15, and 12 mo. The 12-mo. frequency proved more successful. Other examples include frequency for the 50J pump motor on 12-RB cutting machines which was advanced from 12 to 15 mo. with equal results, 15J shuttle-car conveyor motors from 12 to 15 mo. with the possibility of increasing to 18 mo., and hydraulic pumps on shuttle cars and loaders, now changed with the motor.

Establishing a changeout schedule for electric motors required more rescheduling than on other units. At present the schedule permits the motors to be checked before they are changed. If the motor is in good condition the changeout date is advanced; otherwise it is changed out.

In the beginning all hydraulic pumps were put on a regular sched-

ule. They have since been taken off the program because the pumps normally give a warning before going bad. One exception, however, is the 12-RB cutter pump motor which is changed every 3 mo. because of its long replacement time. This information is brought together in the master-schedule board which is shown in the accompanying panel.

Maintenance Organization

As shown in the two accompanying maintenance-organization charts the work load of each supervisor is planned so that his assigned duties could be carried out efficiently. At each mine there is a maintenance foreman to supervise underground trouble shooters. The most important change in the organization was on the third shift. Since the greater part

of the changeout work is done on this shift it is essential to provide a sufficient number of men to make certain that the scheduled changeouts do not lag. Additional foremen for the second and third shifts are furnished at mines having a large number of sections. The number of sections under one third-shift foreman, as shown on the charts, is three at Princess Elkhorn and four at Powellton. There are two mechanics for each section, which is ample manpower to care for equipment and to keep the changeout program on schedule.

One advantage this program did not anticipate was that less skilled men can be used in third-shift changeout. "It has always been a problem to get highly skilled men to work on the third shift," notes Mr. Crace. "The system requires that complete units be replaced rather than rebuilt on the third shift. No special skill is required to change the units. Consequently, we get a high-quality repair job with less skilled men underground and at the same time provide excellent training for beginners."

Shop Crews — The central-shop crew is equally important with the third-shift crews. The shop must see to it that the spare units are repaired or rebuilt as soon as possible. Spare units must be available at all times for routine as well as for emergency needs. The shop force at Princess Elkhorn and Powellton consists of 19 and 21 men, respectively, as follows:

Princess Elkhorn

Machinist
Two welders
Hydraulic repairman
Electric motor serviceman
Drill repairman
Four overhaul and rebuild mechanics
Cable Repairman
Trouble-shooter
Car repairman
Truck repairman
Two utility men (second shift)
Locomotive repairman (third shift)
Overhaul and rebuild mechanic (third shift)
Overhaul and utility man (third shift)

Powellton

Machinist
Two welders
Panelboard rebuild electrician
Drill and stoper repairman
Blacksmith
Two car repairmen
Two motor rebuild electricians
Two unit assembly rebuild mechanics
Two substation men
Communication maintenance man
Two locomotive repairmen
Four electricians

The increased work load of the central shop was assumed by the same number of men employed prior to the program. This absorption was made possible by re-engineering the shop's layout, facilities and methods. A wide range of work can now be performed. There were, of course, many details of change and improvement involved.

Spare Units, Shop Necessities

Desk-type work benches with storage compartments and sliding tool drawers were built for each unit assembly. Each assembly bench was completely stocked with parts to build that particular unit. Each man was assigned a work area in which he would build one or more units. Better lighting, electric impact wrenches and air-operated grease guns were provided. A special cleaning tank was installed for degreasing changed out units before disassembly. The shop was insulated and a central heating plant installed. Fans were put in for summer comfort.

For rebuilding hydraulic pumps and motors, a special test bench was made to test for volume and pressure at various speeds before the pumps and motors were put into service. An electric motor test unit was built using a hydraulic pump and throttling valve for loading. This pump is driven with a V-belt by the motor under test. One pulley is used on

all motors through the use of bushing adapters for different shafts. A motor generator set is used for this testing job only to insure constant voltage. All DC motors up to and including 15 hp are tested 30 min at 100% nameplate load and then 15 min at 150% load. The rpm and temperature rise in all test data are recorded for permanent record.

A follow-up check of equipment is made underground by maintenance supervisors. The supervisors see that the lubrication methods are being followed. When a nonscheduled unit is changed the shop makes a careful inspection to learn whether faulty lubrication is the cause for the change-out. All personnel are notified if poor lubrication is in evidence. Through these improved and more exacting standards and methods the shop personnel has acquired a higher level of skill and productivity.

One of the major expense items was purchasing an adequate supply of spare units. From the outset it took 1½ yr to put the investment on a dividend-paying basis. A partial list of the unit assemblies required to set up the program included: 200J 12-RB cutting-machine motor box, complete; 50J pump motor for cutter; shuttle-car wheel units; 40J and 38J motors for loading machines; speed reducers for all types of motors; extra hydraulic jacks, pumps and control valves; and clutches and transmissions for loaders and cutters. It also was necessary to purchase forward stock to repair and rebuild all the spare unit assemblies.

Application of the unit-changeout system to the tipples also yielded very good results. Delays were reduced 46% in 1 yr. In the course of bringing the delays under control a better-equipped plant was achieved. For example, undependable conveyor chain was replaced with belt. On chain and flight conveyors, speed reducers were changed from spur-gear to worm-gear designs. Slip couplings replaced direct couplings on conveyor lines. Double and triple vibrators were installed in place of eccentric shakers. BX armored cable was replaced with 3-conductor rubber-covered motor and control cable.

Reports and Records

Good records are vital to the program. There is, of course, the ever-

Major Unit Assemblies Included in Princess Coals Changeout Schedule

	Frequency, Months
Pumps	
Spotter	3
6-SC	NF ¹
8-SC, 18-SC	NF
20-BU	NF
14-BU	NF
12-RB	6
Motors and Speed Reducers	
9J 32-E reel	8
9J 32-E conveyor	4
9J 32-E traction	3
9J pump (roof bolter)	3
9J/R 14-BU pump	4
9J/R T-2 traction	4
9J/R compressor	4
10J 20-BU conveyor	3
15J 20-BU conveyor	6
16J/R 8-SC traction	6
8-SC traction	6
15J/R 8-SC and 18-SC pump	6
15J/R 8-SC, 18-SC conveyor	18
15J/R 14-BU traction	NF
15J/R special 14-BU traction	NF
24J/R 6-SC traction	12
24J 6-SC pump	18
24J/R 8-SC traction	15
24J/R 14-BU traction	4
24J 14-BU head	6
30J/R 20-BU main	12
30J/R special 14-BU traction	NF
38J/R 18-SC traction	NF
38J 14-BU head	6
40J/R 14-BU traction	6
40J 14-BU traction	6
50J 12-RB pump	15
200J 12-RB cutting	15
15 hp spotter	12
23T/R elevator	6
Clutches	
20-BU traction	4
20-BU planetary head	4
14-BU-3PE head and trans	6
14-BU-7AE head and trans	6
Mechanical Units	
20-BU disc	3
14-BU-3PE disc	4
14-BU-7AE disc	4
20-BU swivel arm	6
14-BU-7AE swivel arm	12
8-SC wheel unit	12
wheel unit	12
6-SC wheel unit	12
20-BU traction drive	5
¹ / No frequency	

present danger of initiating too much paper work but there is a necessary minimum to do. A fulltime clerk is assigned to the paper work and record keeping. Many different types of forms are designed to gather permanent information. All forms are designed to keep writing to a minimum for the foremen in that only a

Maintenance Ideas

Mine Delay Account Code Simplifies Report Writing

Loader	Shuttle Car		
1. Boom jack	42. Brakes	82. Cutter chain	124. Compressor, crawler truck
2. Brake-digging arm	43. Clutch	83. Dome	125. Drill
3. Conveyor chain	44. Conveyor chain	84. Drive chains	126. Elevator
4. Conveyor drive	45. Conveyor motor	85. Drive shaft (cutter chn.)	127. Hoist
5. Conveyor drive chain	46. Drive chains	86. Elec. motor-cutting	128. Stoper
6. Conveyor motor	47. Drive shaft	87. Elec. motor pump	
7. Conveyor reducer	48. Elec. controls	88. Hyd. controls	NonMechanical
8. Disc	49. Elev. jacks	89. Hyd. hose, fitting	132. Changing cars
9. Foot & head shaft	50. Hyd. control valve	90. Hyd. motor, bug duster	133. Fire and smoke
10. Head chain	51. Hyd. hose, fitting	91. Hyd. motor, reel	134. Incomplete move
11. Head clutch & trans.	52. Sights	92. Hyd. motor, tram	135. Loading dirty bug dust
12. Head jack	53. Misc. elec.	93. Jacks, bar roll	136. Loop wrecks
13. Head motor	54. Misc. hyd.	94. Jacks, bar swing	137. Lost face time
14. Hinge pin	55. Misc. mech.	95. Jacks, bar tilt	138. Lunch
15. Hyd. controls	56. Contactors (pan. bd.)	96. Jacks, boom lift	139. Mine cars hung
16. Hyd. hose & fitting	57. Pump	97. Jacks, boom, swing	140. No coal
17. King pin	58. Pump motor	98. Jacks, steering	141. No cars, haulage
18. Misc. Elec.	59. Reel	99. Misc. elec.	142. No cars, tippie
19. Misc. hyd.	60. Reel motor	100. Misc. hyd.	143. Suppl'es (unloading or hauling to face)
20. Misc. mech.	61. Speed reducer	101. Misc. mech.	144. Top control
21. Contactors (pan. bd.)	62. T'e rods	102. Contactors (pan. bd.)	145. Track repair
22. Planetary head clutch	63. Tires and wheel	103. Pinion core	146. Water and mud control
23. Pump	64. Traction motor	104. Pump	147. Cleaning blocks (pillars)
24. Pump motor	65. Wheel unit	105. Rope	
25. Resistance	66. Wiring	106. Tires and wheels	Miscellaneous Maintenance
26. Sol'd & hollow shaft	67. Wheel chain	107. Universals	150. Locomotive
27. Spring board		108. Wiring	151. Lubrication
28. Swing jack		109. Tail jack, hyd.	152. No power
29. Swing rope			153. Other
30. Swivel-arm slide block	Cables		
31. Timing shaft	70. Buggy	Spotter	Belt-Conveyor System
32. Traction clutch	71. Compressor	112. Chain and dogs	160. Belt
33. Traction drive planetary	72. Cutter	113. Hyd. hose, fitting	161. Belt splices
34. Traction idler sprocket	73. Loader	114. Jacks	162. Drive motor & controller
35. Traction motor	75. Other	115. Miscellaneous	163. Speed reducer & drive mech.
36. Tram chain		116. Motor	164. Lone controls, switches
37. Tread chain	Cutter	117. Contactors (pan. bd.)	165. Troughing, return rollers
38. Wiring	78. Bevel gear	118. Pump	166. Ropes, anchor jacks
39. Traction speed red.	79. Bit clutch	119. Wiring	167. Tailpiece
	80. Bug duster	Miscellaneous Equipment	168. Loading point chute
	81. Cutter bar	123. Air wrench	

Delay Cause Code

Motors, Speed Reducers, Chains	Hydraulic System	Electrical System	
1. Broken parts	21. Abrasion or cutting of hoses	31. Bad contact tips	43. Back spooling
2. Chains fouling	22. Defective connection	32. Corrosion	44. Cable fouling rib or timber
3. Clutches too tight	23. Defective relief valves	33. Defective arc chute	45. Cable too short
4. Defective brushes	24. Low on oil	34. Defective contactor	46. Cut by other equipment
5. Defective contactor	25. Packing blowout	35. Defective mercury tubes	47. Defective reel
6. Defective oil seals	26. Pressure too high	36. Defective overload protection	48. Defective spooling device
7. Defective reducers	27. Overhead	37. Defective wiring	49. Excessive length
8. Digging coal	28. Roofing machine	38. Low voltage	50. Rings too large
9. Excessive oil in reducer		39. Mechanical damage to leads	51. Splice apart
10. Improper adjustment		40. Salt ground	52. Splice too large
11. Loose bolts or fastenings		Cables	53. Torque too high
12. Low voltage		V-Vulcanized splices	54. Torque too low
		T-Temporary splice	55. Water
		N-Original cable	
			All
			58. Miscellaneous

Preparation Plant Delay Account Code

1. R-O-M Conv., 42-in belt	16. Slack drag, No. 1 conv., flight	31. Secondary crusher	50. Lump boom flight, No. 6 track
2. No. 7 conv., 30-in belt	17. 4x0 long dust drag, flight	32. (Future Use)	51, 52. (Future Use)
3. Washer refuse conv., 30-in belt	18. 4x0 dust conv., flight	33. No. 1 vibrating screen	53. Washer
4. Oversize conv., 24-in belt	19. 4x0 dust conv., flight (drag to RR car)	34. No. 2 vibrating screen	54. (Future Use)
5. Crushed 4x0 conv., 24-in belt	20. Sludge conv.	35. No. 3 vibrating screen	55. Air blower and compressor
6. (Future Use)	21-23. (Future Use)	36. No. 4 vibrating screen	56. R-O-M feeder at dump
7. Stockpile conv., 24-in belt	24. Gravity-discharge elevating conv. buckets	37. No. 5 vibrating screen	57. Slurry pump
8. Transfer belt	25. No. 1 comp. refuse elev., bucket	38. No. 6 vibrating screen	58. Recirculating pump
9. (Future Use)	26. No. 2 comp. refuse elev., bucket	39, 40. (Future Use)	59. Fresh water pump
10. Misc. mech.	27, 28. (Future Use)	41. Slurry vibrator	60. Oil pump
11, 12. (Future Use)	29. Vibrating conveyor, 20x30 ft	42. Low-head vibrating screen, stockpile	61. No. 2 layer loader
13. Crusher conv., flight	30. Primary crusher	43. Primary shaker	62. No. 3 layer loader
14. No. 10 cross conv., flight		44. Classifying shaker	63. No. 4 layer loader
15. Rescreen drag conv., flight		45. Picking table	64-70. (Future Use)
		46. (Future Use)	
		47. No. 1 boom belt, No. 3 track	Nonmechanical
		48. No. 2 boom flight, No. 4 track	101. No coal from mine
		49. Egg boom flight, No. 5 track	102. Misc. nonmech
			103. Changing screens
			104-110. (Future Use)

check mark is necessary rather than a lengthy written explanation.

For simplification, a delay account code was set up for mine and preparation equipment. The mine code provides numbers for all delay sources, such as, loading machines, shuttle cars, cutting machines, car spotters, miscellaneous equipment, nonmechanical, miscellaneous maintenance, belt conveyors, motors, speed reducers, chains, hydraulic systems, electrical systems, cables, and all miscellaneous items not specifically included in other parts of the code.

The preparation plant delay-account code provides a number for each equipment item in the plant and also numbers for nonmechanical delays.

Production and Delay Reports—

Each mine foreman and preparation plant foreman fills out a production and delay report at the end of each shift. In addition to the general information contained in mine production reports, the form includes six sections for reporting information on delays:

1. Machine Data—number, type and position.
2. Delay Account—code, unit-assembly or event.
3. Cause of Delay—code, reason for delay.
4. Material Used—quantity, code and part number.
5. Delay Time—total downtime and loading time lost.
6. Repair Cost—labor and material.

Similarly, the preparation plant report, inclusive of general information, provides space for recording delays. The delay record requires that foremen describe delays, record total downtime and preparation time lost and describe repairs and special work performed.

These reports are sent to the superintendent, mine foreman, maintenance foreman and maintenance clerk. The clerk then separates mechanical and nonmechanical delays and records them on an operating summary sheet and a nonmechanical delay worksheet, respectively. This information is transferred to a weekly report and finally to a monthly delay-summary sheet. Separate summary sheets are used for the mine and the preparation plant.

Equipment Checklist—This form, filled out by section and plant foremen, lists the code number and equipment items. Space is provided at the right of each item to indicate whether it is in good condition (check mark) or whether it needs attention (zero mark). At the bottom of the sheet the foreman states the exact reason for placing a zero after equipment items.

The equipment checklist is sent to the maintenance foreman and superintendent of maintenance and then filed in the maintenance office.

Central Shop Rebuild Forms—All unit assemblies listed on the change-out schedule and rebuilt in the shop have special forms which list by name and number all parts required to rebuild a complete assembly.

As changed-out assemblies are received in the shop they are taken to the proper rebuild bench. A form is filled out for each unit. Information includes unit name, section and mine number, machine type, position on machine, starting and completion date and man hours required to rebuild the unit. Part of this information is obtained from a unit assembly tag attached to the assembly which is filled out by the foreman for the section where the unit was changed.

All new parts used in rebuilding the unit are listed on the rebuild form. An important part of the repairman's job is to determine the cause of failure of the unit and to note this along with other pertinent remarks at the bottom of the form. The cost of replacement parts is recorded on the same form by the Purchasing Dept. and then filed by the maintenance clerk. Parts used in rebuilding the units are automatically replenished by the Purchasing Dept. as they list the cost of the items on the rebuild form.

Unit Assembly Tag—Essentially, this tag provides the necessary in-

formation to keep an accurate history of each unit assembly. It is filled out by the section foreman and attached to the changed-out assembly before it goes to the shop for repair. As noted previously the information contained on this tag is transferred to the central shop rebuild form and from there to the unit assembly operating repair summary sheets.

Unit-Assembly Operating Repair Summary—This summary is kept current by the maintenance clerk. The information recorded on this sheet is taken from the central shop rebuild forms and unit assembly tags.

The summary enables the maintenance clerk to make out monthly performance reports on each unit assembly changeout item. Such data as date changed, mine and section, machine number, shift, maintenance cost (labor and material), production delay time and cause or failure are recorded on this sheet.

Similar information is recorded on a somewhat different delay sheet for the preparation plants. A separate sheet is made up for each type of equipment in the plant giving the date, shift, frequency, total downtime and production delay time and code number of the component part that failed.

Unit Assembly Changeout Schedule—This form is basically a repeat of the master unit assembly changeout schedule that is revised monthly. Its main purpose is to provide maintenance foremen with a list of scheduled changeouts for the coming month.

The original form has been expanded to include space for inspection and to note what the inspection revealed or if changed-out, the date of change. Initially, units were scheduled for changeout on a specific date. To give foremen more flexibility in their work program changeouts are now set up on a weekly schedule. For example, a motor previously scheduled for change on Monday can now be changed any day during that week.

Weekly and Monthly Delay Reports—These reports provide a periodic summary of the progress and effectiveness of the preventive-maintenance program. Weekly reports give a quick breakdown of the amount of delays by section (day

Since this article was prepared the Princess Coals, Inc. organization has had two personnel changes as follows:

A. E. Spotte has been transferred from the position of general manager of the Powellton Coal Div. to general manager of sales for Princess Coal Sales Co.

H. B. Price has been promoted from the position of maintenance superintendent of the Powellton Coal Div. to that of general superintendent.

PRINCESS ELKHORN COAL DIV. PRODUCTION DELAY SUMMARY									
MONTH _____									
SECTION		2			15			MINE TOTAL	
Available Work Minutes									
Code No.	LOADER	Mins.	F.	%	Mins.	F.	%	Mins.	F.
1	Boom Jack								
2	Brake-Digging Arm								
3	Conveyor Chain								
4	Conveyor Drive								
5	Conv. Drive Chain								
7	Conveyor Reducer								
8	Disc								
9	Foot & Head Shaft								
10	Head Chain								
11	Head Cl. & Trans.								
12	Head Jack								
36	Tram Chain								
37	Tread Chain								
TOTAL MECHANICAL DELAYS									
6	Conveyor Motor								
13	Head Motor								
33	Wiring								
TOTAL ELECTRICAL DELAYS									
TOTAL LOADER DELAYS									
BUGGY									
42	Brakes								
43	Clutch								
TOTAL MECHANICAL DELAYS									
45	Conveyor Motor								
46	Electric Controls								
TOTAL ALL MECHANICAL DELAYS									
TOTAL ALL ELECTRICAL DELAYS									
TOTAL MECHANICAL & ELECTRICAL DELAYS									
GRAND TOTAL									

MONTHLY DELAY SUMMARY provides space for recording time, frequency and percentage of delays for all components of machines listed in the delay account code.

and night shifts) and the frequency for each delay source. Total delays in minutes, percentage of work time lost and the amount of tonnage lost due to delays completes the weekly summary report.

The monthly delay summary is a more comprehensive report than the weekly. It gives a broader view of the over-all program and enables supervisors to spot weak or trouble areas in the maintenance structure.

Information contained in the monthly summary is obtained from the weekly reports.

The monthly preparation-plant delay summary is similar to the monthly mine report. It lists the individual delays and total delays of each equipment item, frequency of delays and percentage of delays compared to actual operating time. Weekly and monthly reports are sent to all responsible supervisors.

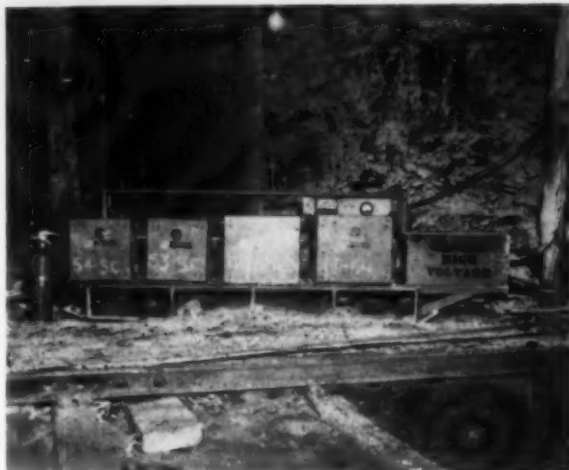
Nonmechanical-delay work sheets are filled out daily from production-delay reports and are used to complete weekly and monthly delay summaries.

In addition to the major reports and records noted, there are others which pinpoint and simplify maintenance practices. These include over-haul-estimate reports, motor-brush inspection forms, substation check-lists, locomotive delay records and maintenance request forms, detailed equipment data sheets, loading-machine conveyor-chain performance records, cutting-machine cutter-chain performance records, shop-repair requisitions and receiving reports, and monthly reports on scheduled vs. emergency changeouts, including reasons for emergency changes when the causes can be determined.

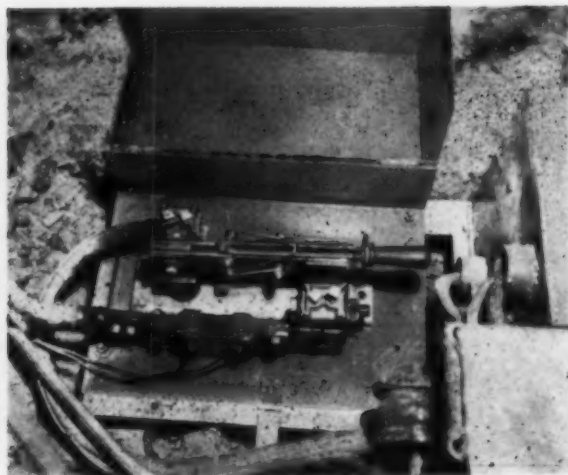
This description likely indicates that a preventive-maintenance system is an expensive operation. Admittedly, there is a substantial initial cost in acquiring spare units, effecting method improvements and modernizing the shop. However, these expenditures can prove to be good investments if they provide a means to convert wasted delay time into production time.

For most mines, each year seems to make production time increasingly valuable. Rising costs, tighter competition and a gradual change in mine conditions leading toward more difficult production circumstances make efficient use of available time imperative. Princess Coals has achieved improved tonnage performances for the past several years. Moreover, maintenance supplies and parts have been held by Princess Coals, despite regular price increases, to a total increase in a 5-yr period of only 6c per ton. These achievements would not have been possible without a constant and organized program directed to the control and reduction of delay time.

The lesson was learned once again that improvement breeds improvement. Stimulation is felt throughout an organization when better methods make work more productive and effective. Everyone reacts to these accomplishments. This maintenance program has made Princess Elkhorn and Powellton more valuable divisions of Princess Coals. Furthermore, they intend to continue to seek better ways to mine coal.



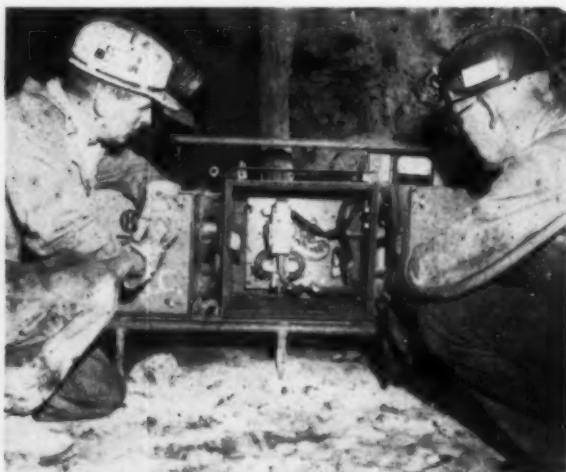
SECTION DISTRIBUTION CENTER features master power switch, circuit interrupters, and a voltmeter and ammeter.



MASTER SWITCH provides quick method for connecting or disconnecting power. Switch cover acts as a safety interlock.



VOLTMETER AND AMMETER enables section foremen and maintenance personnel to check section voltage and load.



SIMPLICITY of the circuit interrupters minimizes maintenance and insures dependability. Breakers are set at factory.

Longer cable life, elimination of cable fires and greater safety for men and equipment are results of . . .

Better Cable Protection With Circuit Interrupters

INDIVIDUAL CABLE MONITORS for loaders, shuttle cars, cutting machines and roof-bolters have been installed at Eastern Coal Corp., Stone, Ky., to protect trailing cables against short circuits and grounds. Hazards and damage which occur when faults develop have been re-

duced by the monitor's ability to trip when even the slightest fault occurs.

The monitor, or Type A Magna-Trip circuit interrupter, manufactured by Ohio Brass, was installed at Eastern Coal on a trial basis about a year ago. After the first unit proved its ability to protect cables with or

without a ground conductor the company adopted a plan whereby it would purchase one Magna-Trip unit each month until all major machines were equipped. Savings in cable cost for each machine equipped with a circuit interrupter will pay for one unit within a 6-mo period.

At present 15 machines, including MT-66 Jeffrey shuttle cars, Acme Jumbolters, 70-UR Jeffrey cutters and 81-A Jeffrey loaders, are equipped with circuit interrupters. Shuttle cars use 100-amp units and loaders, cutters and bolters 300-amp units.

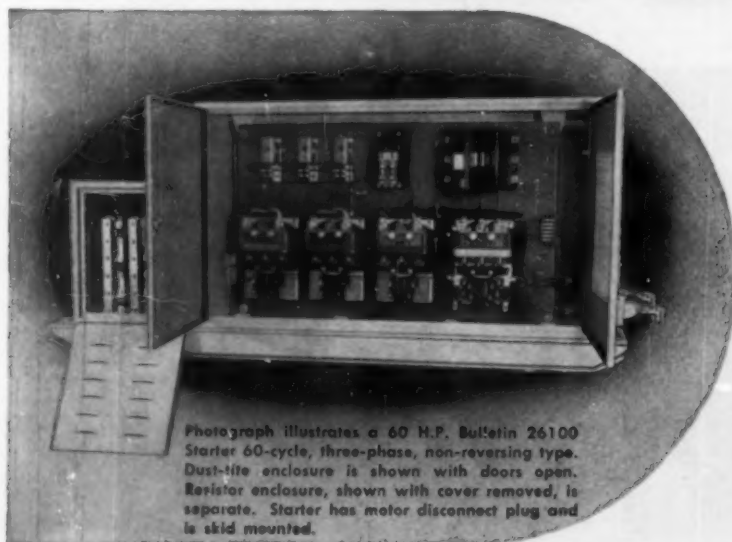
C. A. Gallimore, chief electrician, and Vance Price, general superintendent, list the following advantages of protecting cables with the circuit interrupters.

ENSIGN-CLARK

A. C. Magnetic WOUND ROTOR

MOTOR STARTERS

for...BELT CONVEYORS



Photograph illustrates a 60 H.P. Bulletin 26100 Starter 60-cycle, three-phase, non-reversing type. Dust-tite enclosure is shown with doors open. Resistor enclosure, shown with cover removed, is separate. Starter has motor disconnect plug and is skid mounted.

ENSIGN-CLARK

A. C. MAGNETIC STARTERS ARE ALSO AVAILABLE IN MANUAL REVERSING AND MAGNETIC REVERSING

OPTIONAL FEATURES:

- NEMA 1 Dust-tite or Bureau of Mines Construction.
- Circuit Breaker Disconnect.
- Belt Slippage Protection when used with Centrifugal Switch.
- Control Circuit Transformer.
- Sequence operation when used with Centrifugal Switch.
- Motor Disconnect Plug.
- Skid Mounting.

ENSIGN

ELECTRIC AND

MANUFACTURING CO.

914 Adams Avenue

Huntington 4, W. Va.

Maintenance Ideas

1. Longer cable life.
2. Lower cable-supply cost.
3. Elimination of cable fires, which also eliminates cable smoke on sections.
4. Less damage to short-circuited and grounded cables and, as a result, reduced equipment downtime.
5. Greater safety for men and equipment.
6. Elimination of fused nips.
7. A better basis for a good power distribution setup.

Prior to using the circuit interrupters, normal life of trailing cables on bolting machines, for example, was 5 to 7 mo. Since interrupter installation bolting machines have not had any cables replaced. One cable in particular has been on a bolter for 1 yr and has only one splice. "This," states Mr. Price, "is no accident. We are getting longer cable life from all our cables equipped with circuit interrupters."

As each section of the mine is completely equipped with circuit interrupters, a special skid-mounted distribution center (see photo) is constructed and placed on the section. This distribution center is equipped with a master switch so that power to the section can be connected or disconnected quickly. It also enables section foremen to cut power off all section equipment at the end of the shift by pulling only one switch, thus eliminating the job of hunting for all the nips and possibly leaving one or two nips on.

This one feature alone is very important, especially with equipment using cable reels. Cables spooled on reels are more vulnerable to fires. If by human error, the switch is not pulled and a short or ground develops the circuit interrupter would trip before a fire could start.

A unique feature of the distribution center is that it is equipped with a voltmeter and ammeter. This has proved very helpful to section foremen and maintenance personnel in keeping constant check on voltage and total section load. Individual equipment load also can be measured by disconnecting all equipment except the one to be tested.

With the distribution centers monitoring power on each section, short circuits and grounds no longer represent serious hazards, damage and downtime.

Questions

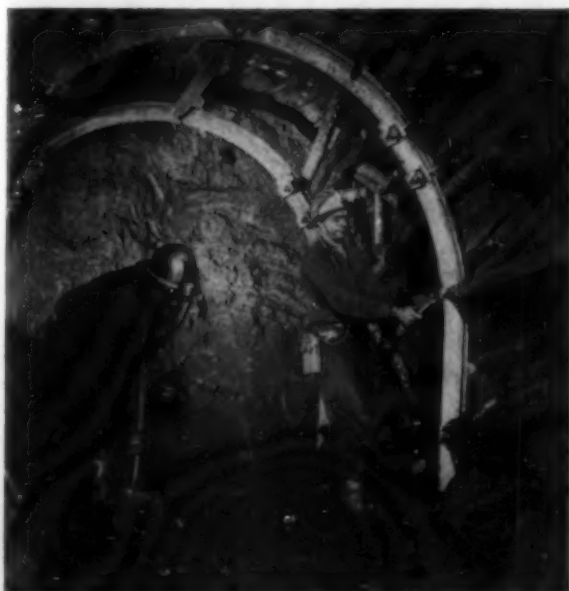
We've been asked about the Yieldable Arch

"When using Yieldable Arches as we advance a drift, is it necessary to install temporary props for support?"

Not at all. You can usually install the Yieldable Arch right next to the breast of the drift. This brings the overburden under immediate and permanent control, without the time and expense of temporary roof support.

And we do mean *control*, for as soon as the surrounding forces bear down too hard, the Yieldable Arch will "give" a little, instead of collapsing. This allows the overburden to settle gradually until it forms a natural pressure arch around the mine opening.

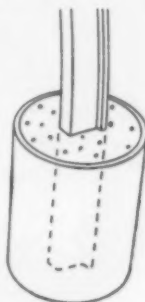
In cases where the ground is heavy, or otherwise bad, forepoling or spiling will give immediate protection while the Arch is being installed.



"What kind of base or footing should be used with the Yieldable Arch?"

If the bottom of your drift is definitely firm, you can set the Arches directly on the rock itself. Otherwise you should set them on footings. Wood blocks are frequently used for this purpose; so are short pieces of steel plates, channels, I-beams or other steel "leftovers."

If an acid water condition exists in your mine, it's well to set the Arch legs in concrete. A short length of pipe will serve as a permanent form in which to pour, as shown in the sketch.



"What is the recommended placement of Yieldable Arch sets in curving drifts?"

Curves present no special problems. Place the sets radially, with the normal strut spacing on the *outside* of the curve. Struts for the inside of the curve are simply cut to suit the reduced spacing.

In the case of a pitching drift, Yieldable Arches should be placed perpendicularly to the drift, not vertically. This makes lagging easier, and also tends to distribute loads more uniformly.

SEND US YOUR QUESTIONS

Send in your questions concerning the application of the Yieldable Arch or Ring to your mine. We will study your problem and reply as promptly as possible. Write Room 1041, at the address below.

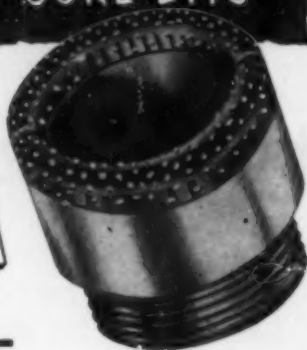
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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BETHLEHEM STEEL



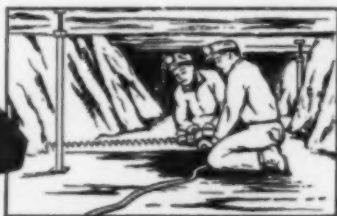
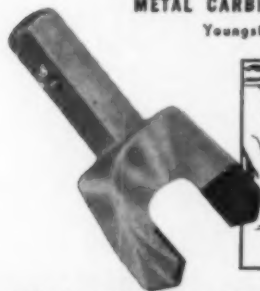
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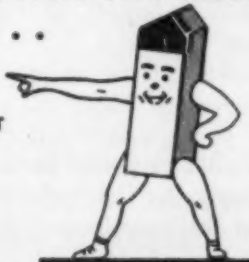
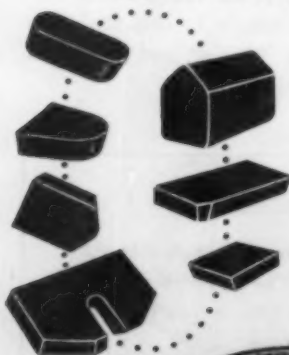
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Youngstown 12, Ohio



Talide Tips for Mining Tools Give These 3 BIG ADVANTAGES . . .

1. EXTRA STRONG
2. SUPER HARD
3. SHOCK RESISTANT

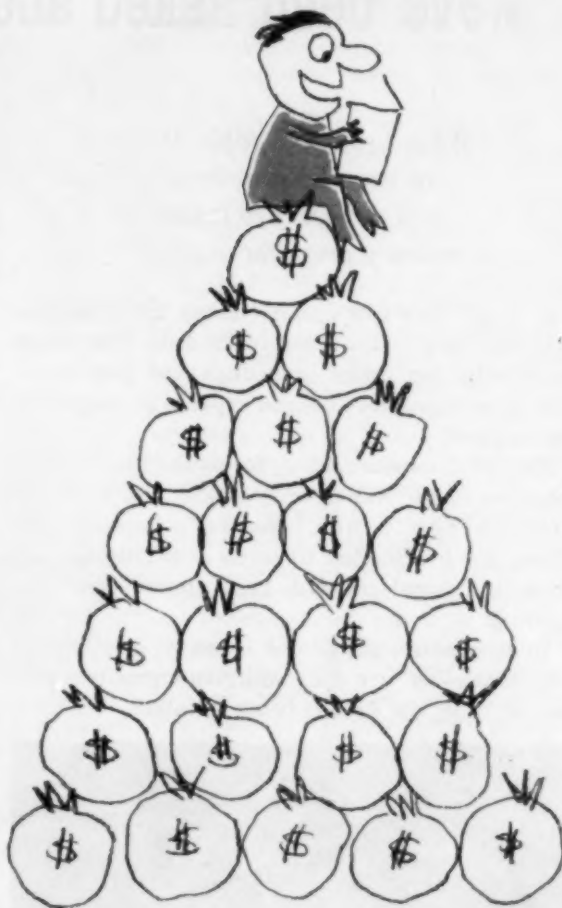


• A complete line of low-cost, high-quality Talide Tips is offered fabricators and users for tipping machine bits, rock bits, drill bits, roof bits and open-pit bits. All Talide Tips have a special surface finish that facilitates brazing. Non-standard shapes and sizes quoted on request.



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HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

Men who
read more
...earn more!



Most of us recall at least one classmate who "never cracked a book", but somehow got by. Wonder where he is today?

Because today, in business and industry, "just getting by" isn't good enough. Sooner or later it spells defeat.

Men who "do crack a book", regularly and well . . . and particularly the McGraw-Hill specialized publication that is edited selfishly for them . . . do their jobs better, get ahead faster.

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Men who read more . . . earn more!



KAISER ALUMINUM MINING PIPE DRASTICALLY REDUCES INSTALLATION AND HANDLING COSTS UNDERGROUND!

Ideal for compressed air lines; spray water lines; mine drainage, filtration and disposal; fuel, steam and water supply lines.

With the emphasis on mine modernization, continuous mining and improved production methods, leading mine operators are finding that Kaiser Aluminum mining pipe meets their needs as no other pipe can. Here's why:

1. Reduced Costs. Aluminum pipe drastically reduces installation costs underground because it's lightweight, easy to cut and fit (even in the overhead position), and requires a minimum of supports or hangers. And, if you use Schedule 5 aluminum pipe in your system, its initial cost is actually less than T&C Schedule 40 steel pipe.

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The advantages of Kaiser Aluminum mining pipe make an important contribution to the coal industry's rapid rate of increased production efficiency. To get all the details on how this strong, lightweight pipe can improve your mining operations and save you money, contact us for the name of your nearest Kaiser Aluminum mining pipe distributor.

For complete information on pipe schedules, sizes, weights and strengths—mail in the coupon now for our free, illustrated booklet, "Kaiser Aluminum Mining and Construction Pipe." Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.



See "Maverick" • Sunday Evenings, ABC-TV Network
Consult your local TV listing



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Oakland 12, Calif.

Name

Address

City State



STRIPPING WORKHORSE at Big Valley Coal is twin-engine bulldozer whose major job is cutting down 20 ft of loose sandstone and soil. Each engine powers one of unit's independent crawlers through a torque converter.

Big Bulldozer Spearheads Low-Cost

Cutting down 70% of the overburden and leveling shovel spoil, twin-engine unit provides maximum flexibility of operations. Diesel-powered shovel removes lower portion of cover at Pennsylvania operation recovering 40-in coal.

SKILLFUL use of a powerful twin-engine bulldozer that cuts down 70% of the overburden provides the base for economical stripping at the Big Valley Coal Co., Slippery Rock, Pa. Big Valley teams the big dozer

with a 2½-yd shovel to remove 30 ft of cover and expose the 40-in Brookville coal.

Overburden consists of 8 to 10 ft of solid sandstone and about 20 ft of loose, broken sandstone and soil.

The company has been in second-cut work since acquiring the property at the beginning of the year.

Before reopening the property, Big Valley management studied the mining conditions and decided that ver-



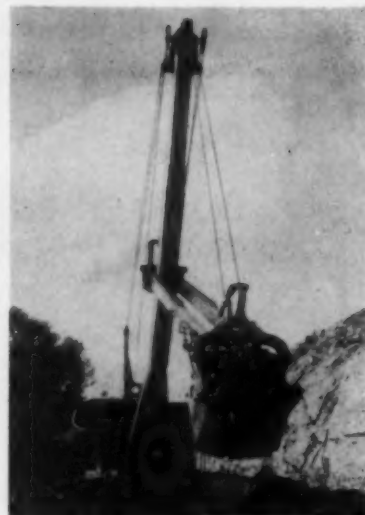
DOUBLE SERVICE as coal loader and stripping unit was assigned to 2½-yd shovel during first 6 mo of operation.



SHARP TEETH on shovel dippers are maintained by regular inspection and hardsurfacing before wear becomes serious.



ADDITIONAL JOB for big bulldozer is moving shovel spoil so that shovel can work more effectively as it handles lower portion of overburden.



DIESEL-POWERED shovel handles lower portion of overburden.

Stripping at Big Valley

satellite machines capable of performing a number of jobs would suit the company's needs best. As a consequence, Big Valley bought a Euclid TC 12 twin-engine bulldozer as a major stripping machine and a Manitowoc 3600 shovel with a 2½-yd Amsco dipper for dual service as a stripping and loading unit. Since studies indicated that a minimum of overburden shooting would be needed, the company decided to contract all overburden drilling.

The TC 12 bulldozer is powered

by two GMC 671 diesel engines with a total of 425 hp. Each engine powers one of the crawlers through a Torquematic torque converter. Each crawler has three forward and three reverse speeds and operates independently of the other. Equipped with a 7-ton all-purpose blade, the dozer's total weight comes to 44 tons.

The 3600 shovel is powered by a Cummins NHRS-6-I diesel engine which transmits power through a Twin Disc torque converter. The unit also has an automatic torque-limiting

device that prevents engine overloading.

On June 22 of this year, Big Valley added a Bay City ½-yd shovel for use exclusively as a coal loader. To add more flexibility to operations, an International TD-9 is used for cleaning the top of the coal in the pit. For loading from the stockpile the company expects to purchase a Tractamotive highlift.

Uncovering the Coal

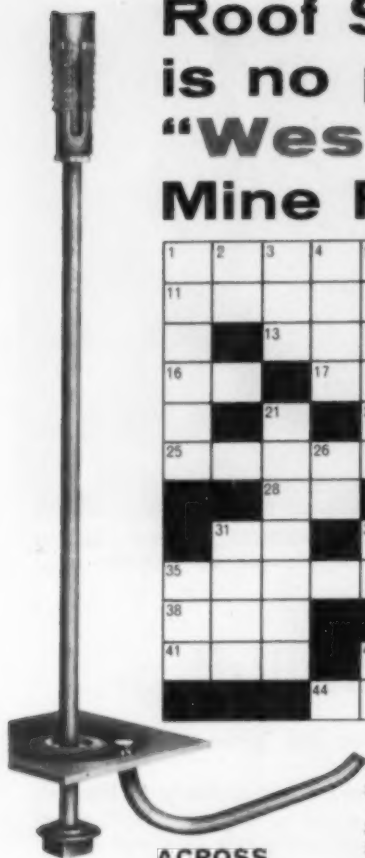
The big TC 12 bulldozer moves the major portion of the overburden, cutting down about 20 ft of loose sandstone and soil. The unit digs at right angles to the outcrop and slices off thin blade-width layers until the hard rock is reached.

At any convenient time after the bulldozer has exposed a large area of solid rock, a contract driller is called in to sink 4½-in holes on 18- to 20-ft centers. Holes in alternate rows are staggered.

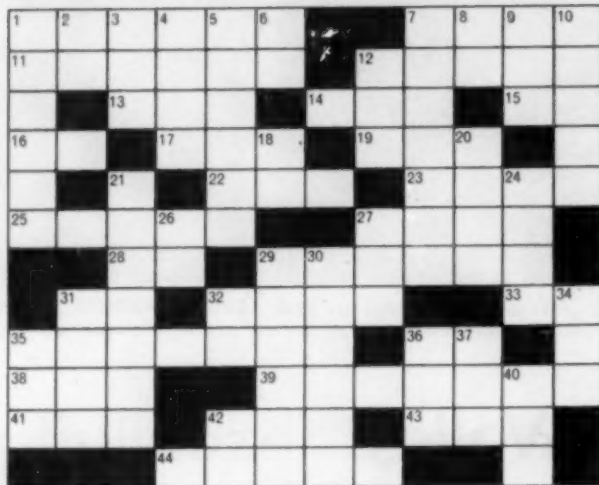
Approximately 50 lb of ammonium nitrate-oil mixture is poured into each drillhole and primed with three sticks of 1½x8-in 40% dynamite and an electric blasting cap. Big Valley mixes the nitrate and oil at the hole site immediately before loading, using 1 gal of fuel oil per bag. Approximately 15 to 20 holes are



TRANSPORTATION for Superintendent Meadows is provided by four-wheel-drive truck with maximum clearance for operating in rough terrain.



Roof Support is no puzzle with "West Virginia" Mine Roof Bolts



ACROSS

1. The initials are H. K.
7. Our product is used in a _____
11. Near by
12. Type of boat
13. Unit of work
14. Hasten
15. Abbr. for type of hauler
16. Russia's answers
17. Used as a Xmas tree
19. And so forth
22. Gain
23. Hard to find
25. Sample
27. Slick
28. Abbr. for company
29. Used for loading & unloading cars
31. Not she

32. Type of neck or with ice cream
33. Steamship (Abbr.)
35. Producers of roof bolts
36. You're reading one
38. Not young
39. Connors stands for

41. _____ Sir! Our favorite answer
42. Wife's desire
43. Size of coal
44. What bolt is made of

DOWN

1. Crazy Friend—Backwards
2. No substitutions please
3. Fish eggs
4. Sod
5. Associated with fires
6. Abbr. for round

7. Starts the shift
8. Where politicians like to be
9. Neither
10. Weird
12. Hint
18. Note of musical scale
20. _____ us for service
21. Gets on up there
24. Let's have a party
26. On _____ to victory
27. Cute for open
29. Twist
30. Protect
31. Less than nothing
32. Same as 28 across
34. Some girls are _____
35. Some girls are _____
36. A very high mountain
37. Expire
40. Coal derivative
42. Abbr. for foot (measuring kind)

For the solution of this puzzle or any other roof support problems, call or write P. O. Box 118, Huntington, W. Va. Phone JACkson 9-7171.

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DIVISION

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FATHER AND SON team, Claude Meadows (top), president; and Delmar Meadows, superintendent, supervises mining operations.

charged, wired in series and set off in each blast.

The 3600 shovel works two shifts exclusively on stripping now that the new Bay City unit is on hand for the coal-loading job. Although the TC 12 bulldozer works only one shift, it is able to keep pace with the stripping shovel and also help cut down and level the shovel spoil.

To maintain dipper teeth as sharp as possible and thereby enable shovels to dig easier, Big Valley takes advantage of every opportunity to build up worn dipper teeth with hardsurfacing material. Tooth buildup is done in the pit when the shovel is in a convenient position and when operations will be least affected.

Management

Big Valley is a family-owned and operated company whose present production goal is 6,000 tons per month. Coal moves to customers by rail and by truck. Claude Meadows is president and treasurer; Mrs. Claude Meadows serves as vice president and secretary; Peggy Meadows is assistant treasurer; and Delmar Meadows is mine superintendent.

FLAME GOES OUT AT ONCE

in test of Thermoid Thermocoal Conveyor Belting

The test? U. S. Bureau of Mines Flame Test, designation U. S. B. M. 28-11.

The material? Thermoid-Quaker *Thermocoal* Conveyor Belting with fire-resistant, flame-retardant neoprene cover and cotton-nylon reinforcement.

The requirements? No more than one minute of burning after the belt is ignited.

The results? The flame went out *immediately* on *Thermocoal* belting. Afterglow disappeared in *one-third* the permitted time.

Underground safety is just one of the features of *Thermocoal* conveyor belting U. S. B. M. 28-11. It is light in weight and extremely flexible, yet tough enough to take shock, impact, and the abrasive wear of heavy, jagged loads.

Get safety, service, and strength for your mine's belting. Call your Thermoid industrial distributor for full information, and for valuable assistance on all problems involving industrial rubber products. Or write today to Thermoid Division, H. K. Porter Company, Inc., Tacony and Comly Streets, Philadelphia 24, Pa.

THERMOID DIVISION

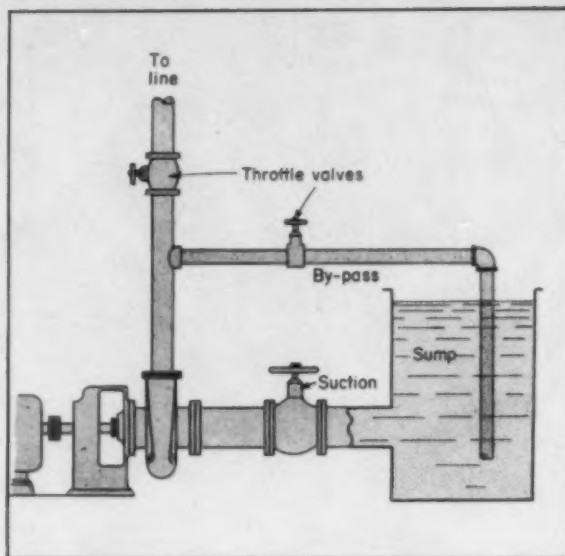
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Helpful Hints On Applying Centrifugal Pumps

IF YOU MUST use a pump at a lower head than that for which it was designed, throttle the discharge; don't choke the suction line.



You may be able to modify that pump you have in storage to solve the water-handling problem you face.

By F. Fraser MacWilliams
Flood City Brass & Electric Co.
Johnstown, Pa.

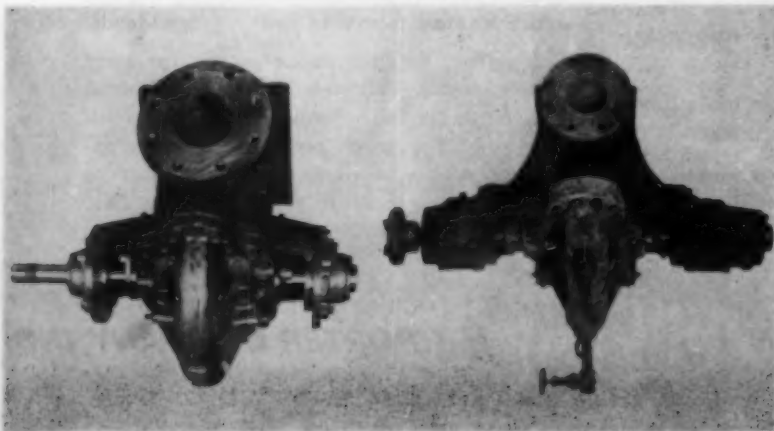
MANY COAL COMPANIES have a number of centrifugal pumps in storage, for one reason or another. Unfortunately, many of these are put back into service under conditions which result in high losses in efficiency and large increases in maintenance costs. Often the name plates are lost, but generally the owner has a pretty good idea of the conditions for which the pump was originally built

to operate, but this is often guesswork.

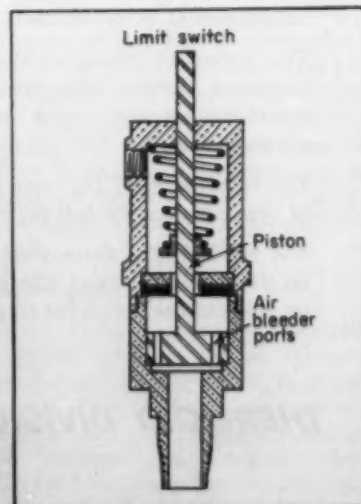
Consideration of a few basic principles will permit much more efficient use of these pumps. They are: (1) the volume varies directly as the speed, (2) the head varies as the square of the speed, and (3) the power varies as the cube of the speed.

Varying the speed, either by changing the actual rpm of the pump or by slightly changing the diameter of the impeller, will enable it to perform satisfactorily under conditions quite different from its original duty.

A typical example is a four-stage pump which delivered 1,600 gpm against a 460-ft head, running at 1,200 rpm. This was actually two two-stage pumps put together with a pipe connecting the two middle stages. The suction half became so badly corroded by acid water as to be beyond repair, and a new case was quite expensive. A study of the basic principles of pump operation showed that running at 1,800 rpm it would deliver 1½ times as much water against 2¼ times the head. So we scrapped the suction half, fitted a packing gland and the original bearing housing to the discharge case, and ran it at 1,800 rpm. With



BEFORE AND AFTER: A change to ball bearings and machining of the impeller resulted in a "new" pump for use under different conditions.



PISTON in this valve operates to shut down motor if pump loses prime.

no other changes, this would, of course, require more power, since it would produce $1\frac{1}{2}$ times the original head, and too much water. So the unit was set in a lathe, and a small cut taken off the impeller. This pump has now been running for several years producing the same amount of water against the same head, and using the same power as the original four-stage pump.

In another instance, a pump was needed for a more or less temporary dewatering job at 500 gpm against a 100-ft head. One was available which had produced 500 gpm against a 280-ft head. Here, of course, about 1,070 rpm would adapt it for a 100-ft head, but it would then produce only about 333 gpm. So we ran it at 1,170 rpm, got about 530 gpm, and everyone was happy. Incidentally, when putting a pump back in service, a lot can be done to modernize and improve it. The "before and after" views show this pump. Originally, this was a sleeve-bearing job with an inefficient type of sealing ring. It was a simple matter to change to ball bearing (see Operating Notes, *Coal Age*, October, 1959, p. 10), and since it needed new rings anyway, a more efficient design was installed.

The only other thing necessary is a better understanding of the curve of the average centrifugal pump. Too many people confuse its characteristics with that of a plunger pump. We still have operators, who, after having burned out one or two motors, tell us, "The pump can't possibly be overloaded. It's built for a 200-ft head and only working against a 100-ft head."

Actually, if the operator will consider it similar in characteristics to his DC generator, with which most of them are familiar, he will keep out of trouble. Just like the DC generator, it generates a constant pressure at no load, which decreases to some extent when the load is applied. The current, or gpm, will depend on the resistance of the circuit. Too low a resistance, whether it be pipe friction or static load, will result in excessive water, and an overload on the driver. Not enough water, assuming the pump is in good condition, can only result from too high a total resistance.

To apply a pump, first decide how many gpm you desire. This has to

be fairly close to what the pump was built for. A large increase means extra mechanical load, with excessive bearing and shaft trouble. A large decrease causes cavitation, vibration and rapid wear. The actual elevation is generally known, and with the gpm given, the pipe friction can be readily figured. Added together, these give the head required, and this should be close to the rated head of the pump. If not, then go back to the three basic principles, and quite often a speed can be found that will fit the pump characteristics to the job.

There are occasions when, in an emergency or for temporary use, a pump has to be applied without any change against a head far lower than it was designed for. Never choke the suction. It will reduce the load on your motor, but the pump won't last long. If you have to, close the discharge valve to the point where your motor will carry the load, and hope that the gpm is still high enough so that no damage results. A much better setup for such a case is shown on the accompanying diagram. This still

wastes power, but the throttle valves can be adjusted so the pump can accomplish the job without damaging anything.

One last hint may generate some disagreement. A lot of time is spent priming pumps, and a lot of damage results from improper priming. Several large mines have removed the check valves from all pumps where the total head is not over about 150 ft. This puts a shock load on the foot valve when the pump stops. However, they have found that a well constructed foot valve will take this load, and the pump is always primed and ready to go when power is applied. For protection, they use the valve shown in the accompanying diagram. The holes in the piston are of such size that air passes through without any movement. As soon as the air is exhausted, the resistance to the water flow is sufficient to cause the piston to rise. Likewise, if at any time the pump loses its water, the piston will drop. A simple limit switch attached to the plunger then shuts down the motor.

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**NEW
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ASSURANCE. When VTI crimps flatten, tension is between 5,500 to 6,500 pounds . . . certain indication of a tight bolt and an anchorage strong enough to support the required tension.

If the VTI crimps have not flattened you know that the bolt has not been tightened to required tension. This may be due to:

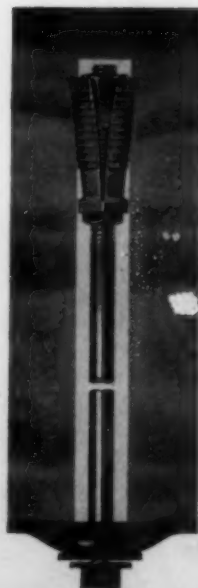
- | | |
|----------------------------|---------------------------------|
| 1. Careless bolting | 5. Improper use of equipment |
| 2. Defective equipment | 6. Defective anchorage material |
| 3. Insufficient anchorage | 7. Inexperienced bolting crew |
| 4. Hole diameter too large | |

Be safe . . . make sure you have a check on all of these by using Youngstown VTI Bolts. They are available in $\frac{3}{4}$ and $\frac{1}{2}$ -inch diameters, 28 to 84-inch lengths with 4-inch rolled threads.

Physical properties of Youngstown VTI Mine Roof Bolts meet or exceed Specification ASTM A-306 as outlined by the Committee on Roof Action. The Youngstown Sheet and Tube Company, Youngstown, Ohio. Carbon, Alloy and Yaloy Steels.

**HOW THE YOUNGSTOWN
 VTI BOLT ASSURES
 SAFE ROOF PRACTICE**

This is a VTI Roof Bolt with non-self-supporting expansion shell, pal nut, and a bell-type roof plate with hardened washers. When tightened with an impact wrench, the VTI crimp flattens somewhere between 5,500 to 6,500 pounds tension. No crimp means a safe roof.



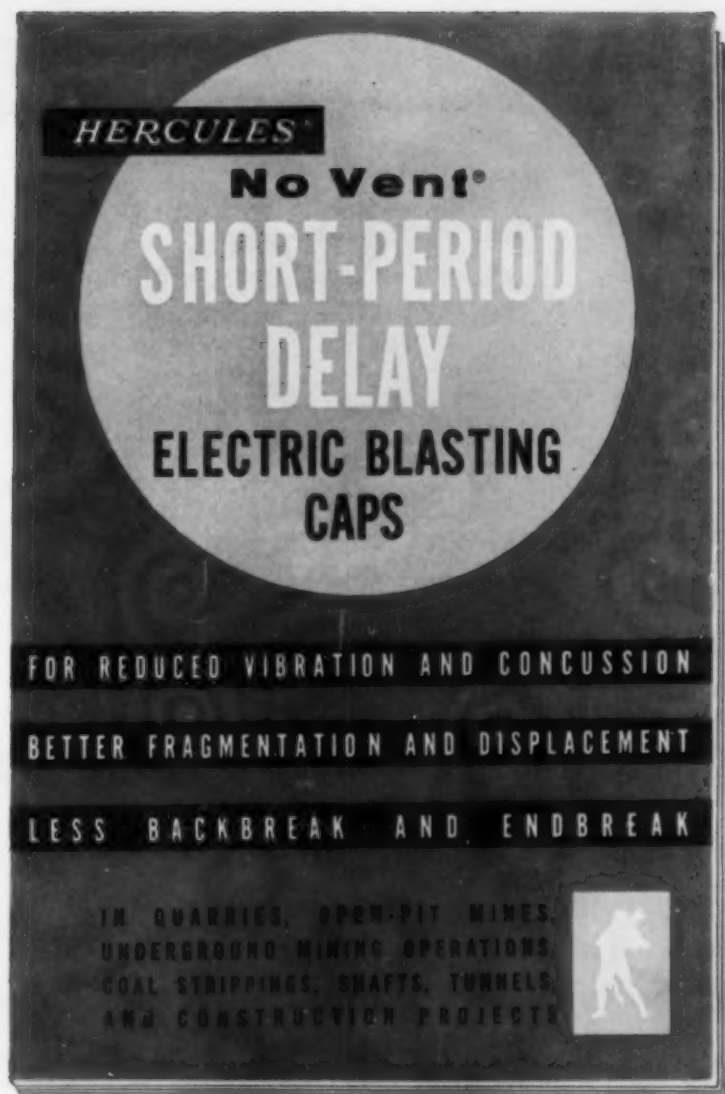
Youngstown

BIRM

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To help acquaint you with this extended series, Hercules has prepared a 20-page booklet describing the characteristics of the caps, indicated uses, and recommended procedures. If you don't already have a copy of this valuable guide, you'll want to ask your Hercules representative for one. At the same time, he'll be glad to tell you more about how Hercules Blasting Caps can best meet your specific requirements.



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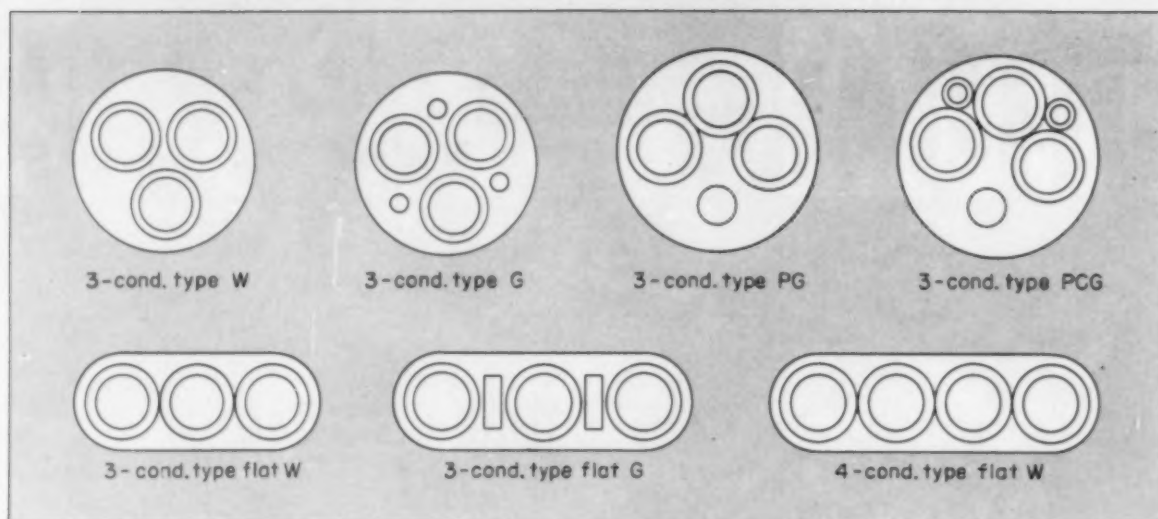


FIG. 1—LOW-VOLTAGE AC mining-machine cables.

AC Cables for Coal . . . Selection, Manufacture, Testing

Types of cables for various mining applications.

Cable selection procedure and principles.

Quality control and testing in manufacture for safety and performance.

F. R. Hugus, Chief Electrical Engineer, Coal Machinery Div., Joy Mfg. Co., Franklin, Pa.

ELECTRIC CABLES used for power supply in coal mining are subjected to so many hazards that they may be considered the weakest link in the chain of production. Yet the utmost in dependability is demanded and expected of cables. If a machine or device in a mine fails to function emergency measures can be taken to bypass it or operate without it, but such emergency measures can seldom be resorted to if the main power cable or a machine cable fails.

Four major factors determine cable dependability:

1. Selection.
2. Installation.
3. Usage.
4. Maintenance.

These four points will be discussed in order. Following the practices sug-

gested can add to the profit of a mine; indifference to them will eventually result in a costly excess of downtime for cable repairs and replacement.

Since cable designs and materials change it would be wise not to accept this information as final. Instead, use it as a means for becoming more familiar with pertinent words, phrases and calculations so that your problems can be discussed intelligently with a cable expert.

Cable Selection

Cables are selected on the basis of:

1. The voltage for which they are rated.

Part I of a two-part feature. Part II, covering installation, use and maintenance of AC cables will appear in the December issue of *Coal Age*.

2. Their conductor operating temperature, which is the sum of the ambient temperature plus temperature resulting from current flow.

3. Voltage drop caused by current flow.

4. Safety features.

1. Voltage Ranges—Low- and high-voltage cables usually are discussed separately. Low-voltage cable is commonly assumed to be any cable suitable for operations using up to 600 V; high-voltage cable, voltages exceeding 600.

Low-voltage AC machine cables are manufactured in several different designs (Fig. 1). Constructions are:

3-conductor Type "W"—Three insulated stranded conductors color coded black, white and green, cabled together and covered with a tough neoprene jacket.

3-conductor Type "G"—Three insulated stranded conductors color coded black, white and red and an uninsulated ground conductor with a total copper area greater than 60% of each conductor divided into three sections and placed in the interstices between the insulated conductors; all cabled together and enclosed in a tough neoprene jacket.

3-conductor Type "PG"—Three insulated stranded power conductors color coded black, white and red and one uninsulated ground conductor with a copper area greater than 50% of each conductor; all cabled together and covered with a tough neoprene jacket.

3-conductor Type "PCG"—Three insulated stranded power conductors color coded black, white and red; two insulated stranded control conductors; and one uninsulated ground wire with a copper area in excess of 50% of the copper area of each main conductor; all cabled together and covered with a tough neoprene jacket.

3-conductor Type "Flat W"—Three insulated stranded conductors, not twisted together but placed side by side, all covered with a tough neoprene jacket to form a rectangular cable instead of the usual round. The color coding has not been formally established but probably will be black, white and green.

3-conductor Type "Flat G"—Three insulated stranded conductors color coded black, white and red, and a ground conductor divided into two sections. The three insulated power conductors are placed side by side and the two uninsulated ground conductors are placed on each side of the center conductor. Combined copper area of the ground conductor is greater than 50% of each main conductor. The entire group of conductors is covered with a tough neoprene jacket to form a rectangular-shaped cable instead of the usual round.

4-conductor Type "Flat W"—Four insulated stranded conductors, color coded black, white, red and green—three for power and the fourth, usually an outer one, for the ground conductor. These four conductors are placed side by side on the same plane and are covered with a tough neoprene jacket to form a rectangular cable instead of the usual round.

The preceding descriptions are based on the conventional neoprene type of cable. In the past few years a plastic-insulated cable has been receiving quite a bit of attention from the mining industry. This plastic cable is insulated and jacketed by being passed once through the machine applying the plastic, whereas with the conventional neoprene-insulated cable each of its insulated conductors is passed through an insulating machine. Then the cabled assembly of insulated conductors and other wires, when used, is passed through a machine which applies the

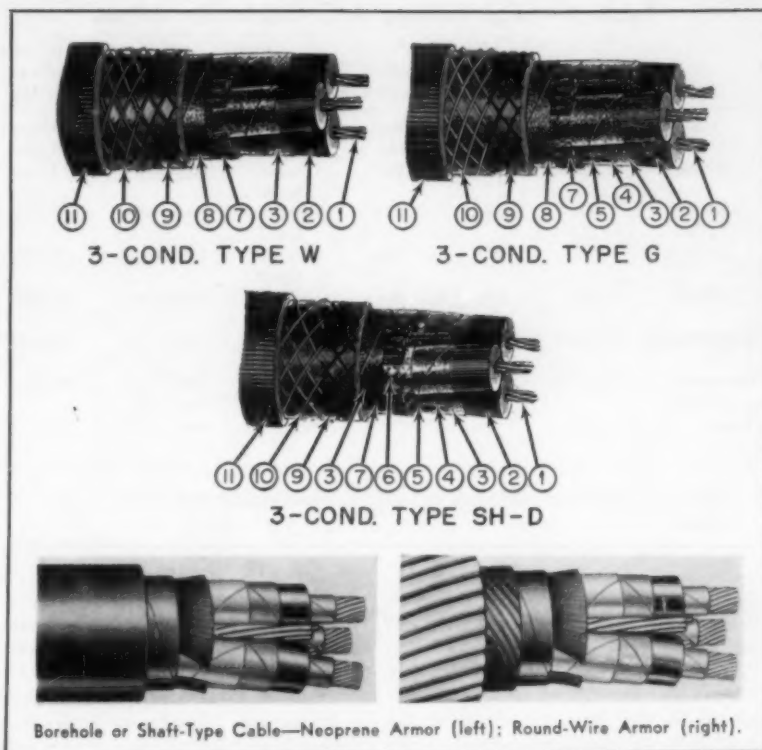


FIG. 2—HIGH-VOLTAGE AC mining cables. 1. Power conductor. 2. Rubber insulation. 3. Tape. 4. Ground conductor. 5. Braid. 6. Copper braid. 7. Jute filling. 8. Tape or binder string. 9. Inner jacket. 10. Seine twine reinforcement. 11. Outer jacket. In the case of 3-conductor Type SH-D one bare ground wire may be used in the center in direct contact with the conductor shields instead of, or in addition to, the three braided ground wires shown.

neoprene jacket to complete the cable.

Plastic insulated cable has not been in use long enough to draw any definite conclusions but it appears to offer many interesting advantages, not the least of which should be an appreciable reduction in cost after the development stages have been passed.

Low-voltage AC mining-machine cables range in size from No. 8 to 4/0 AWC and information on these sizes may be found in all cable-manufacturers' catalogs. Recent concentration of power loads in mines and recent increases in the size and power demands of face machinery have created the need for 3-conductor cable in sizes up to, and including, 500,000 CM. When such large capacity is necessary some mines are using two 3-conductor cables in parallel or three single-conductor cables. If three single-conductor cables are used they must be grouped together as closely as possible. Otherwise the impedance

of the circuit may be increased so much that the value of the larger conductors will be offset by undesirable voltage drop.

High-Voltage Cable

High-voltage cable is available in a variety of designs and voltage ranges (Fig. 2, Table I). Since most mines use 2,300 or 4,160, and some mines are evaluating 7,200 V for distributing power underground, we will consider only the three voltage ranges of 2,000-3,000, 3,000-5,000 and 5,000-8,000.

High-voltage cable designs (Types SH-A, SH-B, SH-C inactive) are:

3-conductor Type "W"—Three rubber-insulated stranded-copper conductors, color coded black, white and green, cabled together and covered with a neoprene armor; no shielding or ground wires and not recommended for use above 3,000 V.

3-conductor Type "G"—Three rubber-

Table I—High-Voltage A-C Cables for Mines

Type	Ground Wires	Shielding*		Type	Armor	Maximum Voltage Rating
		Each Conductor	Cabled Conductors			
W	No	No	No	—	Neoprene	3,000
G	Yes	No	No	—	Neoprene	5,000
SH-A†	No	Yes	No	Copper braid	Neoprene	15,000
SH-B†	No	No	Yes	Copper braid	Neoprene	5,000
SH-C†	Yes	No	Yes	Copper braid	Neoprene	5,000
SH-D	Yes	Yes	No	Copper braid	Neoprene	15,000
Mine Power	Yes	Yes	No	Copper tape	Neoprene	15,000
Borehole and Shaft Type	Optional	Optional	—	Optional	Steel wire, aluminum wire, neoprene, or combination	15,000

*IPCEA recommends shielding at 2,000 V phase-to-phase and higher.

†Inactive.

insulated stranded-copper conductors, color coded black, white and red, and an uninsulated 3-section ground wire, with a copper area of approximately 75% of the capacity of each conductor, placed in the interstices between the insulated conductors; all cabled together and covered with neoprene armor; suitable for use up through 5,000 V; no shielding.

3-conductor Type "SH-A"—Three rubber-insulated stranded-copper conductors, color coded black, white and red; each conductor with copper-braid shielding over its insulation; the three conductors cabled together and covered with neoprene armor; no ground wires; suitable for voltages up to 15,000.

3-conductor Type "SH-B"—Three rubber-insulated stranded-copper conductors, color coded black, white and red, cabled together and covered with copper-braid shielding which, in turn, is covered with neoprene armor; no ground wires; suitable for voltages up to 5,000.

3-conductor Type "SH-C"—Three rubber-insulated stranded-copper conductors, color coded black, white and red; also a 3-section ground with a copper area greater than 60% of the capacity of each conductor fitted in the interstices; all cabled together and covered with copper-braid shielding which, in turn, is covered with neoprene armor; suitable for voltages up to 5,000.

3-conductor Type "SH-D"—Three rubber-insulated stranded-copper conductors, color coded black, white and red, each covered with copper-braid shielding; a 3-section ground with a copper area in excess of 60% of the capacity

of each conductor is fitted in the interstices; this assembly cabled together and covered with neoprene armor; suitable for voltages up to 15,000.

3-conductor Mine-Power Type—Three rubber-insulated stranded copper conductors, each covered with copper-tape shielding; 3-section ground fitted in the interstices of the conductors; assembly cabled and covered with neoprene armor; suitable for operating voltages up to 15,000.

3-conductor Bore-Hole and Shaft type—Three stranded-copper conductors, which may be insulated with a rubber compound or with varnished cambric; ground wires optional; insulated conductors and ground wires, if used, are cabled together with jute fillers; assembly is covered with wire armor; shielding sometimes used on the individual conductors from 2,000 V up and is necessary on cables rated above 5,000; to avoid corrosion problems a rubber or neoprene jacket may be placed under or over the wire armor; wire armor may be galvanized steel or aluminum alloy.

High-voltage cables in sizes from No. 8 to 4/0 are in common use and larger sizes are available on special request. Shielding is recommended for all cables operated at 2,000 V and higher, phase-to-phase. These high-voltage cables can be furnished with insulated pilot wires to provide remote control, communication, etc., but the use of carrier currents on the power conductors should be evaluated before a decision is made to pay for insulated pilot wires, as pilot wires in high-

voltage cables increase the price approximately 2%.

Tables II to V present data compiled from several sources and provide a ready reference for information that usually can be secured only after several tables have been examined. An effort has been made to list the cables used in mines and group them according to the voltage levels encountered.

Fig. 1 includes three cables of the flat type. These designs are so new that standards have not yet been established, but proposals for two of the designs are included in Table II.

The reactance of these flat cables is greater than that of round cables because of conductor position. The resistance of the flat cables is less than that of the round because the conductor and cable lengths are the same for the flat types, while the conductor length is greater than cable length in round cables. This results in the flat cables having less impedance than round.

Many cable tables present resistance, reactance and impedance values on the basis of 1,000 ft of conductor instead of 1,000 ft of cable so that it is necessary to use a multiplier, selected to match the cable construction, to arrive at the proper values for the cable lengths being calculated. The twisted construction of the round cable often results in the conductors being 5% longer—i.e., a 1,000-ft cable probably has 1,050 ft of conductor.

The tables included with this article present resistance, reactance and impedance on the basis of "ohms per conductor per 1,000 ft of cable." Therefore no multiplier is required to compensate for the greater length of conductor resulting from the pitch, or lay, of the cabled conductors.

Table VI shows the change in impedance caused by changes in conductor temperature.

The reactance (X) remains unchanged for various copper temperatures but as the copper temperature increases the cable resistance increases. Impedance is the vector sum of resistance and reactance and is calculated by taking the square root of the sum of the resistance squared plus the reactance squared:

$$\text{Impedance} = \sqrt{\text{Resistance}^2 + \text{Reactance}^2}$$

or,

$$Z = \sqrt{R^2 + X^2}$$

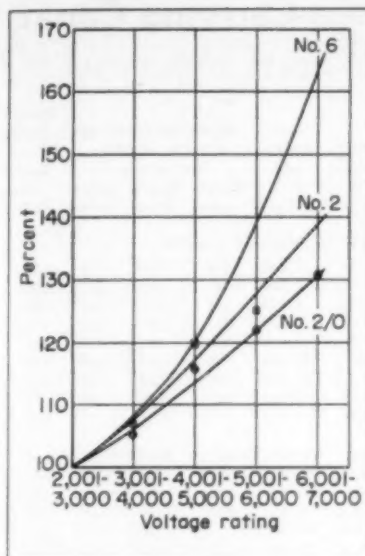


FIG. 3—APPROXIMATE INCREASE (%) in cable list price with increase in voltage rating, Nos. 6, 2 and 2/0 cables, based on 3-conductor Type SH-D.

It is shown in Table VI that the impedance of the smaller cables may be increased 25% if the conductor temperature is raised from 25 C to 90 C. Larger cables are not affected as much because their resistance and reactance are almost equal. Therefore a change in the resistance does not create such a large change in impedance.

Distribution - system calculations should include an analysis of the effect that higher conductor temperatures have on impedance.

Voltage Rating

It is possible to use a cable with a higher voltage rating than necessary but the price will be higher. For example, refer to Fig. 3 showing the approximate increase in cable list price, in %, with increase in voltage rating of the cable. Assume that a No. 2 cable is the right size for a 2,300-V circuit. Cost of this cable is indicated as 100%. If a 3,001- to 4,000-V cable is used, it will be about 108% the cost of the 2,300-V cable; 4,001- to 5,000-V cable, about 117%. Similarly, if cost of a No. 6 cable is analyzed, with its price in the 2,001- to 3,000-V range as 100%, the same-size cable in the 3,001- to 4,000-V range will cost 108%; 4,001- to 5,000-V, about 120%. A similar curve is shown for 2/0 cable.

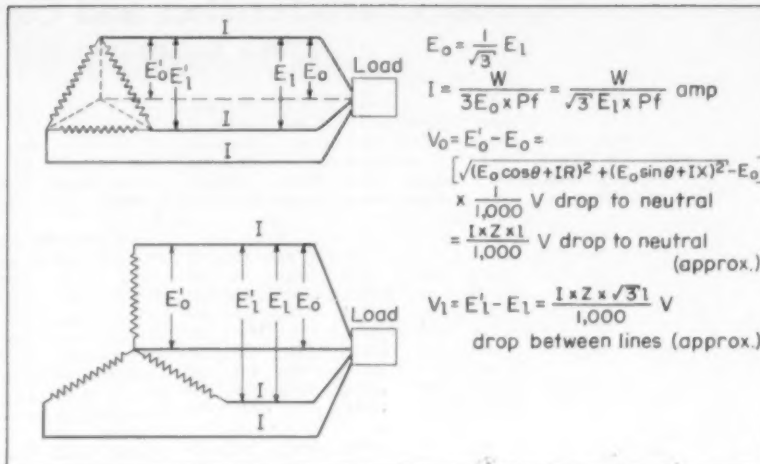


FIG. 4—CIRCUIT DIAGRAMS, 3-phase AC, 3- and 4-wire balanced load.

Current-Carrying Capacity

The flow of electricity through a conductor creates heat which makes the conductor temperature rise. This may be used to perform useful work, as in an incandescent lamp, kitchen stove and other electrical devices, but this heat also puts a limit on the capacity of the unit. Every electrical device has a certain temperature limit above which it cannot operate without experiencing premature failure.

In the case of a cable the maximum operating temperature of the conductor is determined by the insulation and/or jacket material, and usually ranges from 60 to 75 C for portable cables and 70 to 90 C for semi- and nonportable cables. This conductor operating temperature is the sum of the temperature of the air surrounding the cable plus the temperature rise resulting from current flow. This means that a cable in a hot room can carry less current than the same cable in a cool room, as is indicated by the fact that the "current-carrying-capacity" tabulations rate cables lower in a 40 C ambient temperature than in 20 C.

The figure of 40 C is in common use because many cables in factories are installed overhead close to the roof, where temperatures often are quite high. Since most mines have an ambient temperature of 20 C, satisfactory mine cable life, insofar as the effects of heat are concerned, should be attained if cable size is based on current-carrying capacity at 20 C ambient.

Voltage Drop

In selecting cables care must be taken to provide cable large enough to prevent undesirable voltage drop at the load during starting. If the drop is too great, the AC motor may not have enough torque to start the load or the AC contactors may chatter and cause the contact tips to burn together. If a satisfactory voltage condition is maintained during starting the voltage also will be satisfactory while the machine is operating.

The universal recommendation is that the AC voltage applied to a load should not vary more than 10% above or below the nameplate rating of the equipment. Thus, 440-V equipment should not be operated below 396 V nor above 484 V. During normal machine operation, however, a large motor is often started at a voltage below 396. The machine manufacturer should be consulted to secure a practical, satisfactory installation. Usually the manufacturer provides an allowance for the effects of voltage drop during starting.

Voltage-Drop Calculations — Even though the meaning of most of the symbols used in calculating voltage drop can be found on the circuit diagrams in Fig. 4, they are also defined. The letter *E* with subscripts is used to designate a circuit voltage. The primed values, *E'*, designate the sending-end conditions and the unprimed values, *E*, designate the receiving-end conditions. The letter *V* with subscripts indicates a voltage drop. (Continued on p 111)

Physical Characteristics and Current-Carrying Capacity

Table II—600-V Cables

										Per Cond.,													Per Cond.,						
										Current-Carrying Capacity, Amp†													Current-Carrying Capacity, Amp†						
										40 C 20 C													40 C 20 C						
AWG	App. O.D., In²	App. Lb./Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC†	React- ance	Impe- dance			AWG	App. O.D., In²	App. Lb./Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC†	React- ance	Impe- dance			AWG	App. O.D., In²	App. Lb./Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC†	React- ance	Impe- dance		
3-Conductor Type W													4-Conductor Type W (3 power, 1 ground)																
8	.91	.630	5½	1,240	.878	.0376	.878	50	62	8	.99	.723	6	1,640	.878	.0376	.878	50	62	8	.99	.723	6	1,640	.878	.0376	.878	50	62
6	1.01	.764	6½	1,970	.541	.0353	.542	65	81	6	1.10	.900	6½	2,620	.541	.0353	.542	65	81	6	1.10	.900	6½	2,620	.541	.0353	.542	65	81
4	1.17	1.03	7½	3,130	.351	.0334	.353	85	106	4	1.27	1.325	7½	4,170	.351	.0334	.353	85	106	4	1.27	1.325	7½	4,170	.351	.0334	.353	85	106
2	1.34	1.42	8½	4,830	.217	.0314	.219	115	144	2	1.48	1.862	9	6,440	.217	.0314	.219	115	144	2	1.48	1.862	9	6,440	.217	.0314	.219	115	144
1	1.51	1.86	9½	6,090	.173	.0320	.176	130	162	1	1.68	2.54	10½	8,130	.173	.0320	.176	130	162	1	1.68	2.54	10½	8,130	.173	.0320	.176	130	162
1/0	1.65	2.45	10	7,680	.140	.0312	.143	145	181	1/0	1.79	2.73	10½	10,240	.140	.0312	.143	145	181	1/0	1.79	2.73	10½	10,240	.140	.0312	.143	145	181
2/0	1.75	2.73	10½	9,690	.111	.0305	.116	170	212	2/0	1.93	3.56	11½	12,920	.111	.0305	.116	170	212	2/0	1.93	3.56	11½	12,920	.111	.0305	.116	170	212
3/0	1.89	3.41	11½	12,610	.0891	.0295	.0940	195	244	3/0	2.07	4.10	12½	16,290	.0891	.0295	.0940	195	244	3/0	2.07	4.10	12½	16,290	.0891	.0295	.0940	195	244
4/0	2.04	3.97	12½	15,950	.0717	.0290	.0773	220	275	4/0	2.26	4.74	13½	20,550	.0717	.0290	.0773	220	275	4/0	2.26	4.74	13½	20,550	.0717	.0290	.0773	220	275
MCM													MCM																
250	2.39	4.27	14½	18,000	.0612	.0306	.0683	245	306	250	2.66	5.52	16	24,000	.0612	.0306	.0683	245	306	250	2.66	5.52	16	24,000	.0612	.0306	.0683	245	306
300	2.56	4.86	15½	21,600	.0515	.0299	.0594	275	344	300	2.84	6.28	17½	28,800	.0515	.0299	.0594	275	344	300	2.84	6.28	17½	28,800	.0515	.0299	.0594	275	344
350	2.68	5.60	16½	25,200	.0444	.0295	.0531	305	381	350	2.98	7.32	18	33,600	.0444	.0295	.0531	305	381	350	2.98	7.32	18	33,600	.0444	.0295	.0531	305	381
400	2.82	6.45	17	28,800	.0397	.0291	.0491	325	406	400	3.14	8.23	18½	38,400	.0397	.0291	.0491	325	406	400	3.14	8.23	18½	38,400	.0397	.0291	.0491	325	406
450	2.94	7.16	17½	32,400	.0358	.0288	.0461	345	432	450	3.26	9.02	19½	43,200	.0358	.0288	.0461	345	432	450	3.26	9.02	19½	43,200	.0358	.0288	.0461	345	432
500	3.03	7.77	18½	36,000	.0326	.0284	.0431	375	468	500	3.40	9.89	20½	48,000	.0326	.0284	.0431	375	468	500	3.40	9.89	20½	48,000	.0326	.0284	.0431	375	468
3-Conductor Type G													3-Conductor Type PG																
8	.91	.622	5½	1,720	.878	.0376	.878	50	62	8	.93	.665	5½	1,650	.878	.0376	.878	50	62	8	.93	.665	5½	1,650	.878	.0376	.878	50	62
6	1.01	.770	6½	2,450	.541	.0353	.542	65	81	6	1.03	.890	6½	2,380	.541	.0353	.542	65	81	6	1.03	.890	6½	2,380	.541	.0353	.542	65	81
4	1.17	1.04	7½	3,900	.351	.0334	.353	85	106	4	1.20	1.220	7½	3,790	.351	.0334	.353	85	106	4	1.20	1.220	7½	3,790	.351	.0334	.353	85	106
2	1.34	1.45	8½	6,060	.217	.0314	.219	115	144	2	1.34	1.690	8½	5,670	.217	.0314	.219	115	144	2	1.34	1.690	8½	5,670	.217	.0314	.219	115	144
1	1.51	1.94	9½	7,680	.173	.0320	.176	130	162	1	1.52	2.130	9½	7,170	.173	.0320	.176	130	162	1	1.52	2.130	9½	7,170	.173	.0320	.176	130	162
1/0	1.65	2.55	10	9,670	.140	.0312	.143	145	181	1/0	1.68	2.660	10½	9,025	.140	.0312	.143	145	181	1/0	1.68	2.660	10½	9,025	.140	.0312	.143	145	181
2/0	1.75	2.92	10½	12,240	.111	.0305	.116	170	212	2/0	1.79	3.120	10½	11,350	.111	.0305	.116	170	212	2/0	1.79	3.120	10½	11,350	.111	.0305	.116	170	212
3/0	1.89	3.57	11½	15,850	.0891	.0295	.0940	195	244	3/0	1.93	3.760	11½	14,700	.0891	.0295	.0940	195	244	3/0	1.93	3.760	11½	14,700	.0891	.0295	.0940	195	244
4/0	2.04	4.11	12½	19,980	.0717	.0290	.0773	220	275	4/0	2.13	4.480	12½	18,580	.0717	.0290	.0773	220	275	4/0	2.13	4.480	12½	18,580	.0717	.0290	.0773	220	275
MCM													MCM																
250	2.39	4.86	14½	23,140	.0612	.0306	.0683	245	306	250	2.39	5.200	14½	21,330	.0612	.0306	.0683	245	306	250	2.39	5.200	14½	21,330	.0612	.0306	.0683	245	306
300	2.56	5.43	15½	26,740	.0515	.0299	.0594	275	344	300	2.59	6.110	15½	25,670	.0515	.0299	.0594	275	344	300	2.59	6.110	15½	25,670	.0515	.0299	.0594	275	344
350	2.68	6.32	16½	31,200	.0444	.0295	.0531	305	381	350	2.71	6.850	16½	30,340	.0444	.0295	.0531	305	381	350	2.71	6.850	16½	30,340	.0444	.0295	.0531	305	381
400	2.82	7.34	17	36,000	.0397	.0291	.0491	325	406	400	2.83	7.690	17½	33,940	.0397	.0291	.0491	325	406	400	2.83	7.690	17½	33,940	.0397	.0291	.0491	325	406
450	2.94	8.17	17½	39,600	.0358	.0288	.0461	345	432	450	2.98	8.480	18	38,400	.0358	.0288	.0461	345	432	450	2.98	8.480	18	38,400	.0358	.0288	.0461	345	432
500	3.03	8.87	18½	45,600	.0326	.0284	.0431	375	468	500	3.07	9.100	18½	42,000	.0326	.0284	.0431	375	468	500	3.07	9.100	18½	42,000	.0326	.0284	.0431	375	468
3-Conductor Type PCG																													
8	1.03	.705	6½	2,160	.878	.0376	.878	50	62																				
6	1.16	.950	7½	2,893	.541	.0353	.542	65	81																				
4	1.29	1.280	7½	4,300	.351	.0334	.353	85	106																				
2	1.39	1.740	8½	6,183	.217	.0314	.219	115	144																				
1	1.52	2.190	9½	9,200	.173	.0320	.176	130	162																				
1/0	1.68	2.710	10	11,340	.140	.0312	.143	145	181																				
2/0	1.79	3.170	10½	14,060	.111	.0305	.116	170	212																				
3/0	1.93	3.810	11½	15,210	.0891	.0295	.0940	195	244																				
4/0	2.13	4.640	12½	19,100	.0717	.0290	.0773	220	275																				
MCM																													
250	2.39	5.270	14½	21,840	.0612	.0306	.0683	245	306																				
300	2.59	6.310	15½	26,190	.0515	.0299	.0594	275	344																				
350	2.71	6.940	16½	30,850	.0444	.0295	.0531	305	381																				
400	2.83	7.690	17½	34,450	.0397	.0291	.0491	325	406																				
450	2.98	8.570	18	38,910	.0358	.0288	.0461	345	432																				
500	3.07	9.200	18½	42,510	.0326	.0284	.0431	375	468																				

Of Low- and High-Voltage Mining Cables

Table III—2,001- to 3,000-V Cables

AWG	App. O.D., In	App. Lb./Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC*			Per Cond., Current-Carrying Capacity, Amp†		AWG	App. O.D., In	App. Lb./Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC*			Per Cond., Current-Carrying Capacity, Amp†	
					Resist- ance	React- ance	Imped- ance	40 C	20 C						Resist- ance	React- ance	Imped- ance	40 C	20 C
3-Conductor Type W										3-Conductor Type G									
8	1.21	.74	7 3/4	1,240	.878	.0488	.879	50	62	8	1.21	.770	7 3/4	1,720	.878	.0488	.879	50	62
6	1.39	1.24	8 1/4	1,970	.541	.0454	.544	65	81	6	1.39	1.280	8 1/4	2,450	.541	.0454	.544	65	81
4	1.54	1.49	9 1/4	3,130	.339	.0421	.342	85	106	4	1.54	1.560	9 1/4	3,900	.339	.0421	.342	85	106
2	1.72	1.83	10 1/4	4,830	.216	.0392	.220	115	144	2	1.72	1.920	10 1/4	6,060	.216	.0392	.220	115	144
1	1.81	2.03	11	6,090	.173	.0376	.177	130	162	1	1.81	2.180	11	7,680	.173	.0376	.177	130	162
1/0	1.91	2.28	11 1/2	7,680	.139	.0363	.144	145	181	1/0	1.91	2.480	11 1/2	9,670	.139	.0363	.144	145	181
2/0	2.05	3.03	12 3/4	9,710	.111	.0353	.117	170	212	2/0	2.05	3.210	12 3/4	12,240	.111	.0353	.117	170	212
3/0	2.18	3.78	13 1/2	12,610	.0891	.0341	.0952	195	244	3/0	2.18	4.100	13 1/2	15,850	.0891	.0341	.0952	195	244
4/0	2.37	4.30	14 1/2	15,950	.0713	.0331	.0785	220	275	4/0	2.37	4.690	14 1/2	19,990	.0713	.0331	.0785	220	275
MCM										MCM									
250	2.56	4.88	15	18,000	.0610	.0333	.0695	245	306	250	2.56	5.51	15 1/2	23,140	.0610	.0333	.0695	245	306
300	2.69	5.32	16 1/4	21,600	.0513	.0324	.0607	275	344	300	2.69	6.12	16 1/4	26,740	.0513	.0324	.0607	275	344
350	2.85	6.13	17 1/4	25,200	.0443	.0318	.0545	305	381	350	2.85	7.13	17 1/4	31,200	.0443	.0318	.0545	305	381
400	2.96	6.77	17 3/4	28,800	.0395	.0314	.0504	325	406	400	2.96	8.04	17 3/4	36,000	.0395	.0314	.0504	325	406
500	3.20	8.11	19 3/4	36,000	.0323	.0307	.0446	375	468	500	3.20	10.00	19 3/4	45,600	.0323	.0307	.0446	375	468

3-Conductor Type SH-D

8	1.42	1.36	8 3/4	1,720	.878	.0518	.879	50	62
6	1.62	1.57	9 3/4	2,450	.541	.0496	.543	65	81
4	1.77	1.96	10 3/4	3,900	.339	.0462	.342	85	106
2	1.92	2.32	11 3/4	6,060	.216	.0427	.220	115	144
1	2.04	2.94	12 1/4	7,680	.173	.0410	.178	130	162
1/0	2.18	3.82	13 1/4	9,670	.139	.0396	.145	145	181
2/0	2.29	4.23	13 3/4	12,240	.111	.0382	.118	170	212
3/0	2.45	4.65	14 3/4	15,850	.0891	.0369	.0962	195	244
4/0	2.62	5.29	15 3/4	19,990	.0713	.0359	.0795	220	275
MCM									
250	2.78	5.59	16 3/4	23,140	.0610	.0357	.0706	245	306
300	2.94	6.33	17 3/4	26,740	.0513	.0349	.0620	275	344
350	3.02	6.55	18 3/4	31,200	.0443	.0340	.0558	305	381
400	3.19	7.88	19 3/4	36,000	.0395	.0334	.0517	325	406
500	3.37	9.31	20 3/4	45,600	.0323	.0327	.0460	375	468

AWG	Strand- ing	App. OD, in	App. Lb./Ft. Net	Min. Bend. Rad. in	App. Breaking Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60 Cycles AC†			Per Cond. Current-Carrying-Capacity‡			
						Resistance	Reactance	Impedance	Mine Power Feeder 40 C	20 C	Borehole 40 C	20 C
3-Conductor Mine Power Feeder and Nonarmored Borehole Cables (Unshielded)												
8	1	1.00	.644	4	1,710	.841	.0450	.841	60	70	50	60
6	7	1.22	.968	6¼	2,740	.545	.0441	.548	75	90	65	75
4	7	1.36	1,249	6¾	4,080	.344	.0409	.346	100	120	85	100
2	7	1.49	1,808	7½	6,390	.217	.0380	.220	130	155	110	130
1	19	1.59	2,056	8	8,050	.173	.0365	.177	150	175	130	155
1/0	19	1.67	2,365	8¾	10,170	.139	.0353	.143	170	200	145	170
2/0	19	1.81	2,772	9¼	12,830	.110	.0343	.115	200	235	165	195
3/0	19	1.93	3,235	9¾	16,160	.0886	.0332	.0945	225	265	190	225
4/0	19	2.05	4,392	12¾	20,220	.0704	.0321	.0773	260	305	215	255
MCM												
250	37	2.25	5,044	13½	26,030	.0608	.0323	.0688	285	335	240	280
300	37	2.40	5,926	14½	29,280	.0511	.0315	.0600	320	380	265	310
350	37	2.51	6,599	15¼	32,800	.0441	.0309	.0538	355	420	290	340
400	37	2.62	7,408	15¾	38,310	.0391	.0305	.0495	380	460	315	370
500	37	2.80	8,996	16¾	48,130	.0320	.0298	.0437	440	520	360	425

*Based on 75 C (167 F) copper.

†Based on 75 C (167 F) copper for Types W, G and SH-D; 90 C (194 F) copper for mine power feeder and nonarmored borehole cable; and 20 C and 40 C (68 and 104 F) ambient for all types; 2,001- to 3,000-V mine power feeder and nonarmored borehole cable not covered by IPCEA specifications.

‡Based on 90 C (194 F) copper.

Physical Characteristics and Current-Carrying Capacity

Table IV—3,001- to 5,000-V Cables

Per Cond.,										Per Cond.,									
Current-Carrying Capacity, Amp†										Current-Carrying Capacity, Amp†									
Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC*										Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC*									
Resist- React- Imped- 40 C 20 C										Resist- React- Imped- 40 C 20 C									
AWG	App. O.D., In	App. Lb/ Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Resist- ance	React- ance	Imped- ance	40 C	20 C	AWG	App. O.D., In	App. Lb/ Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Resist- ance	React- ance	Imped- ance	40 C	20 C
3-Conductor Type G										3-Conductor Type SH-D									
6	1.55	1.43	9½	2,450	.541	.0483	.542	65	81	6	1.78	1.81	10¾	2,450	.541	.0520	.543	65	81
4	1.67	1.67	10	3,900	.339	.0448	.342	85	106	4	1.90	2.22	11½	3,900	.339	.0485	.342	85	106
2	1.86	2.07	11½	6,060	.216	.0416	.219	115	144	2	2.09	3.50	12½	6,060	.216	.0449	.221	115	144
1	1.97	2.36	11½	7,680	.173	.0398	.178	130	163	1	2.18	3.72	13½	7,680	.173	.0432	.178	130	163
1/0	2.08	2.98	12½	9,670	.139	.0385	.145	145	181	1/0	2.34	4.17	14½	9,670	.139	.0416	.145	145	181
2/0	2.19	3.89	13½	12,240	.111	.0374	.117	170	212	2/0	2.46	4.58	14¾	12,240	.111	.0401	.118	170	212
3/0	2.36	4.31	14	15,850	.0891	.0360	.0960	195	244	3/0	2.62	5.02	15¾	15,850	.0891	.0387	.0970	195	244
4/0	2.50	4.86	14¾	19,900	.0713	.0349	.0793	220	275	4/0	2.76	5.61	16¾	19,990	.0713	.0373	.0803	220	275
MCM										MCM									
250	2.69	5.69	16	23,140	.0610	.0349	.0702	245	306	250	2.92	5.99	17½	23,140	.0610	.0371	.0712	245	306
300	2.86	5.59	17½	26,740	.0513	.0340	.0615	275	344	300	3.07	6.78	18½	26,740	.0513	.0361	.0627	275	344
350	2.98	7.43	17½	31,200	.0443	.0334	.0555	305	381	350	3.19	7.53	19½	31,200	.0443	.0355	.0567	305	381
400	3.13	8.53	18¾	36,000	.0395	.0327	.0512	325	406	400	3.33	8.32	20	36,000	.0395	.0349	.0527	325	406
500	3.37	10.66	20¼	45,600	.0323	.0319	.0454	375	469	500	3.51	9.71	21¼	45,600	.0323	.0337	.0465	375	468
3-Conductor Mine Power										3-Conductor Borehole or Shaft Type (Nonarmored)									
6	1.43	1.38	17½	2,740	.545	.0469	.547	85	100	6	1.43	1.38	17½	2,740	.545	.0469	.547	70	85
4	1.54	1.83	18½	4,080	.344	.0436	.346	110	130	4	1.54	1.83	18½	4,080	.344	.0436	.346	90	105
2	1.68	2.19	20¼	6,390	.217	.0404	.221	145	170	2	1.68	2.19	20¼	6,390	.217	.0404	.221	115	135
1	1.79	2.48	21½	8,050	.173	.0386	.177	165	195	1	1.79	2.48	21½	8,050	.173	.0386	.177	135	160
1/0	1.88	2.77	22½	10,170	.139	.0374	.144	190	220	1/0	1.88	2.77	22½	10,170	.139	.0374	.144	155	185
2/0	1.99	3.21	23½	12,830	.110	.0363	.116	225	265	2/0	1.99	3.21	23½	12,830	.110	.0363	.116	175	205
3/0	2.10	4.23	25¼	16,160	.0886	.0350	.0950	250	295	3/0	2.10	4.23	25¼	16,160	.0886	.0350	.0950	200	235
4/0	2.23	4.49	26¼	20,220	.0704	.0339	.0780	285	335	4/0	2.23	4.49	26¼	20,220	.0704	.0339	.0780	230	270
MCM										MCM									
250	2.45	5.54	29½	26,030	.0608	.0334	.0695	315	370	250	2.45	5.54	29½	26,030	.0608	.0334	.0695	255	300
300	2.58	6.32	31	29,280	.0511	.0330	.0608	350	415	300	2.58	6.32	31	29,280	.0511	.0330	.0608	280	330
350	2.69	6.82	32½	32,800	.0441	.0324	.0546	390	460	350	2.69	6.82	32½	32,800	.0441	.0324	.0546	310	365
400	2.79	7.91	33½	38,310	.0391	.0317	.0503	420	495	400	2.79	7.91	33½	38,310	.0391	.0317	.0503	330	390
500	2.97	9.06	35½	48,130	.0320	.0310	.0445	475	560	500	2.97	9.06	35½	48,130	.0320	.0310	.0445	380	450

*Based on 75 C (167 F) copper.

†Based on 75 C (167 F) copper for Types G and SH-D; 90 C (194 F) for mine feeder and borehole or shaft types, and 20 and 40 C (68 and 104 F) ambient for all types.

Table V—5,001- to 8,000-V Cables

Per Cond.,										Per Cond.,											
App. O.D., In				App. Lb/ Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC*			Current- Carrying Capacity, Amp†	App. O.D., In				App. Lb/ Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC*			Current- Carrying Capacity, Amp†
AWG	In						Resist- ance	React- ance	Imped- ance	40 C 20 C	AWG	In						Resist- ance	React- ance	Imped- ance	40 C 20 C
3-Conductor Type SH-D											3-Conductor Mine-Power Type										
4	2.14	1.64	17¼	3,900	.339	.0515	.342	95	119		4	1.72	1.88	10¼	4,080	.344	.0469	.348	110	130	
2	2.32	2.15	18½	6,060	.216	.0478	.222	125	156		2	1.86	2.31	11¼	6,390	.217	.0434	.222	140	170	
1	2.41	2.41	19½	7,680	.173	.0457	.179	140	175		1	1.96	2.66	11½	8,050	.173	.0416	.179	160	190	
1/0	2.55	2.75	20½	9,670	.139	.0440	.146	165	206		1/0	2.05	2.97	12	10,170	.139	.0402	.145	190	230	
2/0	2.69	3.27	21½	12,240	.111	.0425	.119	190	240		2/0	2.17	3.42	13	12,830	.110	.0387	.117	220	265	
3/0	2.82	3.96	22½	15,850	.0891	.0410	.0980	215	269		3/0	2.28	4.01	13½	16,160	.0886	.0373	.0964	245	295	
4/0	2.99	4.59	23½	19,940	.0713	.0396	.0815	245	310		4/0	2.41	5.01	14½	20,220	.0704	.0361	.0792	280	335	
MCM											MCM										
250	3.05	6.32	24½	23,140	.0610	.0386	.0722	270	340		250	2.60	5.55	15½	26,030	.0608	.0354	.0704	350	420	
300	3.24	7.21	25½	26,740	.0513	.0376	.0635	300	375		300	2.73	6.29	16½	29,280	.0511	.0346	.0619	385	460	
350	3.33	7.90	26½	31,200	.0443	.0366	.0575	335	418		350	2.83	6.77	17	32,800	.0441	.0338	.0566	410	490	
400	3.48	8.91	27½	36,000	.0395	.0361	.0535	360	450		400	2.95	7.67	17½	38,310	.0391	.0330	.0513	440	530	
500	3.67	10.21	29½	45,600	.0323	.0349	.0475	410	515		500	3.13	9.51	18½	48,130	.0320	.0323	.0465	475	570	

Of Low- and High-Voltage Mining Cables

Table V—Continued

AWG	App. O.D., In	App. Lb/ Ft. Net	Min. Bend. Rad., In	App. Break- ing Str., Lb	Ohms per Cond. per 1,000 Ft of Cable, 60-Cycle AC*			Per Cond., Current-Carrying Capacity, Amp†	
					Resist- ance	React- ance	Impe- dance	40 C	20 C
3-Conductor Borehole or Shaft Type (Nonarmored)									
4	1.72	1.88	10¼	4,080	.344	.0469	.348	85	100
2	1.86	2.31	11¼	6,390	.217	.0434	.222	115	135
1	1.96	2.66	11¾	8,050	.173	.0416	.179	130	155
1/0	2.05	2.97	12	10,170	.139	.0402	.145	150	180
2/0	2.17	3.42	13	12,830	.110	.0387	.117	170	205
3/0	2.28	4.01	13¾	16,160	.0886	.0373	.0964	195	235
4/0	2.41	5.01	14½	20,220	.0704	.0361	.0792	220	265
MCM									
250	2.60	5.55	15¼	26,030	.0608	.0354	.0704	240	290
300	2.73	6.29	16½	29,280	.0511	.0346	.0619	265	320
350	2.83	6.77	17	32,800	.0441	.0338	.0556	290	350
400	2.95	7.67	17¾	38,310	.0391	.0330	.0513	310	370
500	3.13	9.51	18¾	48,130	.0320	.0323	.0455	350	420

*Based on 75 C (167 F) copper.

†Based on 75 C (167 F) copper for Type SH-D; 85 C (185 F) for mine-feeder and borehole or shaft types, and 20 and 40 C (68 and 104 F) ambient for all types.

I = Line current, amperes.

E_o, E_s = Sending- and receiving- end voltages to neutral.

E₁, E₂ = Sending- and receiving- end voltages between lines.

E_p, E_p = Sending- and receiving- end voltages per phase.

V_o = E_o - E_s = Voltage drop to neutral.

V₁ = E₁ - E₂ = Voltage drop between lines.

R = DC or AC resistance of line, ohms per conductor per 1,000 ft of cable.

X = 60-cycle reactance of line, ohms per conductor per 1,000 ft of cable.

Z = 60-cycle impedance of line, ohms per conductor per 1,000 ft of cable.

l = Length of line, ft.

w = Watts delivered.

p.f. = Cos θ = power factor of load.

θ = Power-factor angle of load.

The following example shows the usual steps in calculating cable size and voltage drop. Assume a 60-hp 440-V motor 400 ft from the power source.

1. A typical tabulation shows that a 60-hp 440-V 3-phase motor draws 75 amp.

2. Data in Table II for a 600-V 3-conductor Type "C" cable indicates that a No. 4 cable will have adequate current-carrying capacity with 40 C ambient and a No. 6 with 20 C ambient. Voltage-drop calculations are made for both sizes.

3. Voltage drop between lines for rated load is:

No. 4 Cable

$$V_1 = I \times Z \times \sqrt{3} \times \frac{1}{1,000}$$

$$= 75 \times .353 \times \sqrt{3} \times \frac{400}{1,000}$$

$$= 18.3 \text{ V,}$$

(Z = .353, Table II)

With 440 V at the power-supply end of the 400-ft cable the voltage at the motor terminals is

$$440 - 18.3 = 421.7 \text{ V, or, } 440 - 28.1 = 411.9 \text{ V}$$

4. If the inrush current at the instant of starting is six times the rated current, this much current is:

$$6 \times 75, \text{ or } 450 \text{ amp,}$$

and the voltage drop during starting is:

$$V_1 = 450 \times .353 \times \sqrt{3} \times \frac{400}{1,000}, \text{ or, } 450 \times .542 \times \sqrt{3} \times \frac{400}{1,000}$$

$$= 110 \text{ V,}$$

$$= 169 \text{ V}$$

If the voltage at the supply end of the 400-ft-long cable is kept at 440, voltage at the motor terminals will be:

$$440 - 110 = 330 \text{ V, or, } 440 - 169 = 271 \text{ V}$$

Percent rated voltage applied to the motor during starting is:

$$\frac{100 \times 330}{440} = 75\%, \text{ or, } \frac{100 \times 271}{440} = 61.6\%$$

The motor starting torque will be reduced as the square of the voltage.

T starting, with 75% rated voltage (75%) = 56.3%

With 61.6% rated voltage (61.6%) = 38%

If the motor is a Design B, 1,800 rpm unit the breakaway, or starting, torque will be about 150% normal running torque when rated voltage is applied to the motor terminals during starting. No. 4 cable reduces

Summary of Bureau of Mines

"Portable-Cable Flame-Resistance Tests"

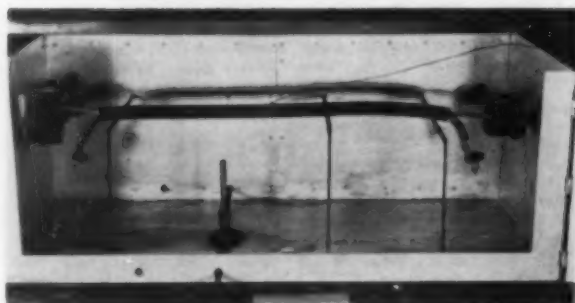


FIG. 5—SPECIMEN for portable-cable flame resistance test mounted in test cabinet.

Specimen

1. The test specimen shall consist of a straight 3-ft length of cable.
2. The sheath or jacket shall be removed from the terminal ends of a multiconductor specimen a distance of approximately 5 in and insulation compound shall be removed a distance of approximately 2½ in from the end of each conductor. Single-conductor cable shall have the insulation and jacket removed for a distance of approximately 2½ in (see Fig. 5).
3. The conductors of the specimen, except those to be connected to the source of power, shall be connected to provide (a) a series circuit for cables (Size 8 AWG or larger); (b) a parallel or series circuit for cords (smaller than Size 8 AWG).

Test Apparatus and Facilities

1. The source of electric current for loading the cable specimen may be either AC or DC, shall have sufficient current capacity, and shall be provided with a means for closely regulating current value.
2. A suitable ammeter shall be provided for measuring the electric current load imposed on the cable-specimen conductors.
3. A suitable temperature-measuring device or devices shall be provided to determine the copper or conductor temperature.
4. A rack shall be provided for supporting the cable specimen and it shall have three metal rods with a spacing between the first and the middle of 16 in, and between the middle and last, 8 in, center-to-center. The rods shall be wrapped with asbestos tape to minimize the cooling effect, and the height of the rack shall be sufficient to permit the inner cone tip of a Tirrell burner to just contact the sheath of the cable specimen when the flame has been adjusted to proper height.
5. A timing device shall be provided, such as, a stop clock or watch equipped with a second hand that makes 1 rpm, and it shall have a minute indicator.
6. A standard 3/8-in Tirrell burner for igniting the cable specimen at the hereafter designated time shall be provided.
7. A ventilated hood or canopy substantially free from external air currents on the sample shall be provided for conducting the test.

Test Procedure

1. **General**—The test procedure provides that a specimen of cable properly mounted shall have current loading of the prescribed value applied until the conductor temperature reaches 400 F, at which time the Tirrell burner flame shall be

applied to the cable for a period of 1 min. At the end of this time both the current and the Tirrell burner shall be removed and the time of burning and the propagation distance measured.

2. **Specimen Mounting**—The cable specimen shall be placed in the rack and connected to the electric current source. The specimen shall be adjusted in the rack so that it is centered on the two outer supporting rods, with approximately 1 in of sheath or jacket extending beyond each rod (see Fig. 5).

3. **Temperature Measurement**—The thermocouple of the temperature-measuring device shall be held in intimate contact with the copper conductor by inserting the thermocouple under a flap of sheath and insulation at 26 in from the first end of the specimen. The flap shall be held tightly, after insertion of the thermocouple, by tying securely with wire, asbestos or other suitable binding.

4. **Current Loading**—The current loading of the specimen conductors shall be 500% of the normal current rating (400% in excess of such rating) as specified by IPCEA for "Rubber-Sheathed Portable Power Cables" (No. 8 conductor and larger) or as specified by the National Electrical Code for Flexible Cords (No. 14, No. 12 and No. 10) as given in Table VII. The current load shall be maintained on the cable specimen until the conductor temperature reaches 400 F, and for 1 min.

5. **Application of Flame**—The ignition of the cable specimen shall be by the flame of a Tirrell burner of nominal 3/8-in bore; the inner cone of the flame shall be 3 in in height; the over-all height of the flame shall be 5 in. The tip of the inner cone shall be placed against the bottom sheath of the specimen at a point midway between the first and middle supporting rods (14 in from the extreme left-hand end of the specimen) after the conductor temperature specified has been attained, and allowed to remain in this position for 1 min before it is removed.

6. **Test Data**—The burning time (after the 1 min ignition time) shall be noted and recorded. The total extent of flame propagation, as measured between the two extreme charred or otherwise destroyed points on the sheath of the cable specimen, shall be recorded as inches propagation.

7. **Test Limits**—Two out of three test specimens shall meet the following:

Burning time, 4 min or less.

Propagation, 6 in or less.

Cables which have successfully passed the flame-resistant tests are marked with a three-digit number followed by a dash and the letters "BM". This marking is placed on the jacket of the cable at intervals not to exceed 12 ft.

The foregoing regulations deal with tests to determine the flame-resistant characteristics of 600-V mining cable. Similar tests for high-voltage cable are not so far advanced. However, reputable cable manufacturers understand the importance of flame-resistant requirements and can readily furnish flame-resistant-type cable for high-voltage installations. Care should be taken to specify this feature when ordering both high-voltage and low-voltage cable.

Table VI—Change of Resistance and Reactance with Change in Copper Temperature

Cond. Size	25 C	60 C Copper				75 C Copper				90 C Copper			
	Copper, Impedance	Resistance	Reactance	Impedance	% Increase in Impedance	Resistance	Reactance	Impedance	% Increase in Impedance	Resistance	Reactance	Impedance	% Increase in Impedance
3-CONDUCTOR TYPES "W" AND "G", 600 V													
6	.454	.514	.0353	.515	13.4	.541	.0353	.542	19.4	.567	.0353	.568	25.0
2	.1847	.207	.0314	.2095	13.4	.217	.0314	.2190	18.6	.228	.0314	.2300	24.5
4/0	.0667	.0682	.0290	.0741	11.1	.0717	.0290	.0773	15.9	.0751	.0290	.0805	20.7
300 MCM	.0527	.049	.0299	.0574	8.9	.0515	.0299	.0594	12.7	.054	.0299	.0617	17.1
500 MCM	.0394	.031	.0284	.0420	6.6	.0326	.0284	.0431	9.4	.0341	.0284	.0444	12.7

Resistance, reactance and impedance values are in ohms per conductor per 1,000 ft of cable.

this starting torque to 56.3% of normal or 84.5% (150% x 56.3), and No. 6 cable reduces the starting torque to 38% of normal, or 57%. If a load with light breakaway torque is being started (such as a fan), the No. 6 cable should be satisfactory but if the load has a higher breakaway torque No. 4 cable should be used. In fact, if the breakaway torque is more than 84.5% of rated load torque, No. 4 cable will be too small for the job.

The calculations have been based on 75 C copper. If cable-conductor temperature is below 75 C the resistance and impedance, and the voltage drop, will be less (see Table VI for examples).

In addition to starting-torque considerations the effect the voltage drop might have on the linestarter should be evaluated. If the linestarter is located beside the motor it probably will chatter during starting unless it is equipped with a special coil that will hold it closed at voltages under the 80% dropout voltage value usually found in standard linestarters used on mine-type equipment.

When conditions similar to those we have just calculated are encountered it is recommended that No. 4 cable be used. In fact, if the cable is longer than 400 ft, it may be necessary to use a cable larger than No. 4, even though No. 4 or even No. 6 is large enough to carry the current of the motor, because voltage drop during starting may prevent the motor from picking up the load or the AC contactor may chatter and burn the contact tips together.

Safety Features

Anyone ever involved in any way with a fire underground can readily understand the importance of exercising every precaution to avoid fires in mines. This attitude has prompted the Bureau of Mines to place Sec. 18.30, "Portable Cable Flame Resistance Tests," in Schedule 2F. Copies of this schedule may be secured from the Bureau of Mines. These requirements are summarized in an accompanying panel.

Cables which have successfully passed the flame-resistant tests are marked with a letter P followed by a three-digit number followed by a dash and the letters BM. This marking is placed on the jacket of the cable at intervals not to exceed 12 ft. By the end of July, 1959, 24 cable companies had secured the Bureau of Mines approval for flame-resistant cable and symbols from 101-BM to 127-BM have been assigned to these companies for use on their cables.

IPCEA — Further uniformity of cable construction and quality also is promoted by the Insulated Power Cable Engineers' Association, organized in March, 1925. Its membership is composed of engineers from the technical staffs of companies manufacturing paper-insulated, varnished-cloth-insulated or rubber, rubber-like and thermoplastic-insulated power and communication cables. The purpose of this organization is to promote safety, reliability and economy of insulated cables for the transmission and distribution of electric power.

The mining industry is interested

in rubber, rubber-like and thermoplastic cables primarily, and IPCEA Standard S-19-81, which deals with these type of cable, include recommendations on (1) solid and stranded conductors, (2) insulation, (3) test methods, (4) shielding practices, (5) coverings (cotton, jute, saturants, finishes, etc.), (6) special constructions, (7) color coding, (8) shielding, (9) splices, (10) dimensions, and other aspects.

Quality Control

The quality of any manufacturer's cable is determined by (1) the types and number of quality-control tests given the cable and its components, and (2) the courage and experience displayed by men responsible for evaluating the results of the quality-control tests.

Obviously a wide range of quality can be built into cables. Some manufacturers with limited facilities and a poor quality-control program may produce good cable time after time but there is a good chance that their cable will be good at certain times and poor at others—a condition that can be determined by the user only after the cable has been in service for a period of time. Other manufacturers have extensive test facilities and use them conscientiously to supply shipment after shipment of high-quality cable.

Test facilities alone are insufficient to guarantee good cable. They must be used by men who are experienced enough to determine the desired cable quality without creating un-

necessary expense by being too conservative. These men must have the confidence and support of their management.

Cable evaluation should be based on several viewpoints. The most important is, "How well have various manufacturers' cables performed in your mine?" This evaluation should be based primarily on records supplemented by the opinions of men using and repairing the cable. You can compare your conclusions with opinions of men in other mines. You should make an inspection of the plants of several manufacturers to become familiar with their manufacturing and test facilities and to determine how often these test facilities are being used. Some companies keep impressive equipment in neat condition, which may indicate infrequent use, and others are so busy testing cables they do not have time to concentrate on good house-keeping.

An understanding of cable-manufacturing and test procedures should give the user a better understanding of strengths and weaknesses of cable and enable him to use cable in a way that will give the best life.

Reputable cable manufacturers have a thorough testing schedule for all of the cords and cables they make. A number of tests are made on every foot of cable. Others are made on a statistical basis. There are still others made to check specific important characteristics of cables for a specific job. Chemical, physical, electrical and visual tests are made at appropriate times.

Table VII—Normal Current Rating—Amperes per Conductor
For "Portable-Cable Flame-Resistance Tests"

Cables, Conductor Size	Single Conduc- tor	2-Conductor			3-con- ductor	4-con- ductor	5-con- ductor	6-con- ductor
		Flat	Concen- tric	Round				
8	45	40	—	40	35	30	25	20
6	60	50	50	50	50	40	35	30
4	85	70	65	70	65	55	45	35
3	95	80	75	80	75	65	55	45
2	110	95	90	95	90	75	65	55
1	130	110	100	110	100	85	75	65
1/0	150	130	120	130	120	100	90	80
2/0	175	150	135	150	135	115	105	95
3/0	205	175	160	175	155	130	120	110
4/0	235	200	180	200	180	150	140	130
MCM								
250,000	275	220	—	220	200	160	—	—
300,000	305	240	—	240	220	175	—	—
350,000	345	260	—	260	235	190	—	—
400,000	375	280	—	280	250	200	—	—
450,000	400	300	—	300	270	215	—	—
500,000	425	320	—	320	290	230	—	—
Cords								
		1-3 Conductor		4-6 Conductor		7-9 Conductor		
No. 14		15		12		8		
No. 12		20		16		11		
No. 10		25		20		14		

Tests performed by cable manufacturers in their factories and laboratories can be arranged in these groups:

Raw-material tests.
In-process tests.
Finished-cable tests.
Special tests.

The components and the cable are rejected at any point where they do not meet the required specifications.

Raw-Material Tests — All lots of raw materials are sampled and inspected for compliance with specifications. For example, tests are made

on the rubber stocks, compounding ingredients, copper rods, copper tape, galvanized steel-wire armor, jute filling and serving materials, semiconducting tapes and all other raw materials.

In-Process Testing — All components are inspected and tested throughout the manufacturing process. For example, each foot of insulated conductor is given a voltage test (1) after insulating, (2) after cabling, and (3) again after it is jacketed.

Finished-Cable Tests — 1. Each foot of cable is given a voltage test (see Tables VIII and IX). This test

Table VIII—Factory Test Voltages
for High-Voltage Cables

These cables are, in general, nonportable types and are, therefore, provided with an insulation which is very high quality electrically with adequate physical properties. For portable cables, physical properties as well as electrical properties weigh heavily in the choice of compound. As such, a compromise is necessary between physical and electrical properties for such cables. This is apparent from the higher test voltages which are required for the cables covered by this table.

Each conductor is placed in water and soaked 12 hr. It is then given a high-voltage test as shown in Col. 1.

Each completed cable (except shielded) is placed in water and soaked 12 hr. It is then given a high-voltage test at the values shown in Col. 2. Shielded cables are tested dry at the values in Col. 2.

*The insulation thickness indicates that the voltage rating of the cable varies between 600 and 15,000 V.

Insulation Thickness, 64ths In*	Test Voltage			
	COL. 1		COL. 2†	
	AC for 5 Min	DC for 15 Min	AC for 5 Min	DC for 15 Min
5	9,300	31,100‡	9,300	31,100‡
6	11,200	37,400‡	11,200	37,400‡
7	13,100	43,500	13,100	43,500
8	14,900	49,800	14,900	49,800
9	16,800	56,000	16,800	56,000
10	18,700	62,300	18,700	62,300
11	20,500	68,500	20,500	68,500
12	22,400	74,700	22,400	74,700
13	24,300	81,000	24,300	81,000
14	26,200	87,100	26,200	87,100
15	28,000	93,300	28,000	93,300
16	29,900	99,500	29,900	99,500
17	31,800	105,700	31,800	105,700
18	33,700	112,000	33,700	112,000
19	35,500	118,800	35,500	118,800

‡Steel-wire-armored borehole or shaft cables get 80% of these test voltages.

‡5 min only.

Table IX—Factory Test Voltages for Portable Rubber Cable

Each insulated conductor is placed in water and soaked for 12 hr. It is then given a high-voltage test at the values in Col. 1.

Each finished cable (except shielded) is placed in water and soaked for 12 hr. It is then given a high-voltage test at the values in Col. 2.

The purpose of the water is to provide a good ground reference so that all the insulation can be checked. On shielded cables the shield provides the ground reference and thus the water soak is unnecessary.

Some cables, as listed below, have special test voltages as finished cables:

	Test Voltage for 5 Min.
Welding Cable.....	1,200
Multicond. & Twin Type G or W, Sizes #8-#2 AWG..	6,000
#1-4/0.....	7,000
Concentric #8-#2 AWG.....	5,000
#1-4/0 AWG.....	6,000

Insulation Thickness, 64ths In*	Test Voltage, AC for 5 Min	Col. 1	Col. 2
4	5,500	5,000	
5	6,800	6,200	
6	8,200	7,500	
7	9,600	8,700	
8	11,000	10,000	
9	12,300	11,200	
10	13,700	12,500	
11	15,100	13,700	
12	16,500	15,000	
13	17,800	16,200	
14	19,200	17,500	
15	20,600	18,700	
16	21,900	20,000	
17	23,300	21,200	
18	24,700	22,500	
19	26,000	23,700	
20	27,500	25,000	
21	28,800	26,200	
22	30,200	27,500	

*The range of insulation thickness indicates that the voltage rating of the cable varies between 600 and 17,000 V.

is made between conductors and from each conductor to ground.

2. Insulation resistance is measured for each conductor.

3. Each of the several conductors is checked for continuity.

4. Each cable is checked for diameter, tolerances and imperfections in the jacket.

5. Periodic samples are obtained for (a) physical testing as a check on manufacturing uniformity; (b) Pennsylvania and Federal Bureau of Mines flame test.

In addition to these other tests may be made to meet the requirements of customers' specifications.

Special Tests — Most of the tests enumerated below are made to check the suitability of various materials or completed cable for some intended service conditions. The list is only a partial one. Many of these tests are performed in combination with others so that there are endless combinations of tests made. Some are quantitative. Quite a few, however, such as, compression resistance and abrasion resistance, are purely qualitative; that is, it is only possible to compare results of one material with another on a percentage basis rather than on absolute values. Each of these tests, enumerated below, are identified as physical, electrical or chemical by the symbols P, E, or C, respectively.

Tests for All Nonleaded Cables

Tensile (P)
Elongation (P)
Voltage (E)
Insulation resistance (E)
Chemical resistance (C)
Electrical and mechanical water absorption (E & C, respectively)
Corrosion (E & C)
Cold bend (P)
Heat shock (P)
Sun cracking (C)
Cold-shattering temperature (P)

Cold-cracking temperature (P)
Bending (P)
Conductor resistance (E)
Compatibility—all components are checked chemically for compatibility with all other materials used in these cables.

Tests for Portable Cables

Jacket abrasion (P)
Twisting (P)
Bending (P)
Impact (P)
Tear resistance (P)
Oil resistance (C)
Flame (P)
Adhesion (P)
Compression resistance (P)
Tensile strength of cable (P)

Tests for High-Voltage Cables

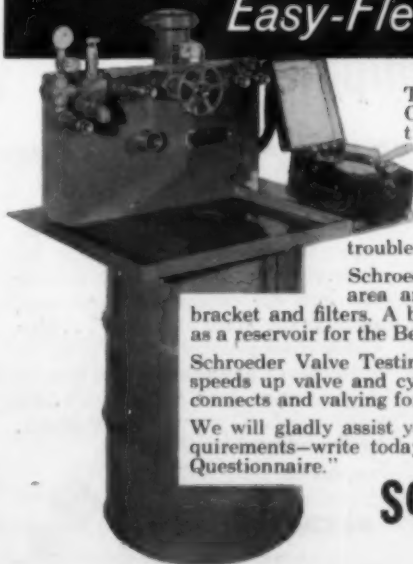
AC, DC and impulse voltage (E)
Load cycle (E)
Ozone resistance (C & E)
Ionization factor (E)
Corona level (E)
Power factor (E)
Dielectric constant (E)
Dielectric loss (E)
Current heating (E)

Tests for Telephone or Communication Cable

Attenuation (E)
Characteristic impedance (E)
Capacitance (E)
Capacitance unbalance (E)
Resistance unbalance (E)

BUILD YOUR OWN SCHROEDER HYDRAULIC BARREL TEST BENCH

Easy-Flexible-Low Cost



The Schroeder Portable Hydraulic Circuit Tester now teams up with the newly-designed Schroeder Bench Table to provide fast, accurate, and complete test bench instrumentation. Yet, the Tester may be removed from the Bench quickly for trouble-shooting in the mine or in the shop.

Schroeder Bench Table serves as work area and support for Tester, valve test bracket and filters. A barrel supports the Table and acts as a reservoir for the Bench.

Schroeder Valve Testing Header added to Barrel Bench speeds up valve and cylinder testing; provides quick disconnects and valving for faster, efficient operation.

We will gladly assist you in determining your Bench requirements—write today for the Schroeder "Test Bench Questionnaire."

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Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristics.

Heavier outside wires in each strand have greater resistance to abrasion.

"Herringbone* saves our equipment"

AMICO SAND AND GRAVEL COMPANY

Read this about the most exciting wire rope development in years . . . "Turning a profit on any product often boils down to something that will do a specific job better than anything else. Our equipment operators prefer Roebling Herringbone to any other for heavy lifts, clam shell, drag, pan work or dozers. The savings on sheaves, because of Herringbone's perfect tracking, are a big item as far as we are concerned."

Amico Sand and Gravel Company, Morrisville, Pennsylvania, and Riverside, New Jersey, has told you what

this combined regular lay and Lang lay rope—two-ropes-in-one—is doing for them. Roebling is in a position to show you how the new Herringbone can, again, in the words of Amico ". . . give you a chance to turn more profit on production equipment." Write to Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, for the full and fabulous facts.

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Branch Offices in Principal Cities
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How to get **EXTRA** truck-trips per shift

Sharp turning angles and easy handling are important reasons why Macks can shave precious minutes from your truck cycle time . . . give you *extra* trips—bonus earning time—shift after shift.

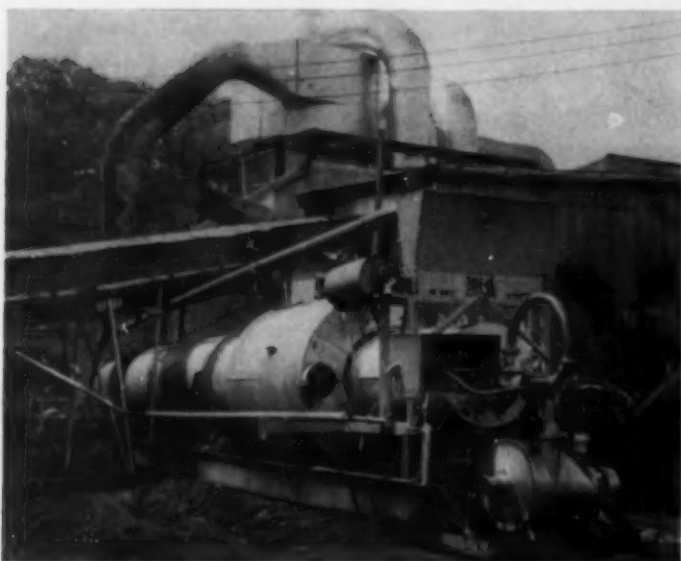
Spotting under shovels in 1-2-3 order; negotiating hairpin turns with capacity loads aboard; backing into the tightest corners with

swift smoothness—big Macks are a study in maneuverability.

Moreover, Macks have the extra guts and go for steady, economical performance on the world's most rugged jobs . . . jobs that wear out other makes over the long haul. There's a heavy- or super-duty Mack, up to 40-ton capacity, that's engineered to and beyond your specifications. Check your

Mack branch or distributor today. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

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FIRST NAME FOR
TRUCKS



MINIMUM SPACE requirements and ease of installation add to the advantages of the dryer. No building is needed to house the unit.



ELECTRONIC CONTROLS (above) make the dryer completely automatic.

Newly-developed rotary-kiln coal dryer leads to . . .

Low-Cost Thermal Drying, Increased Plant Efficiency, Quality Products

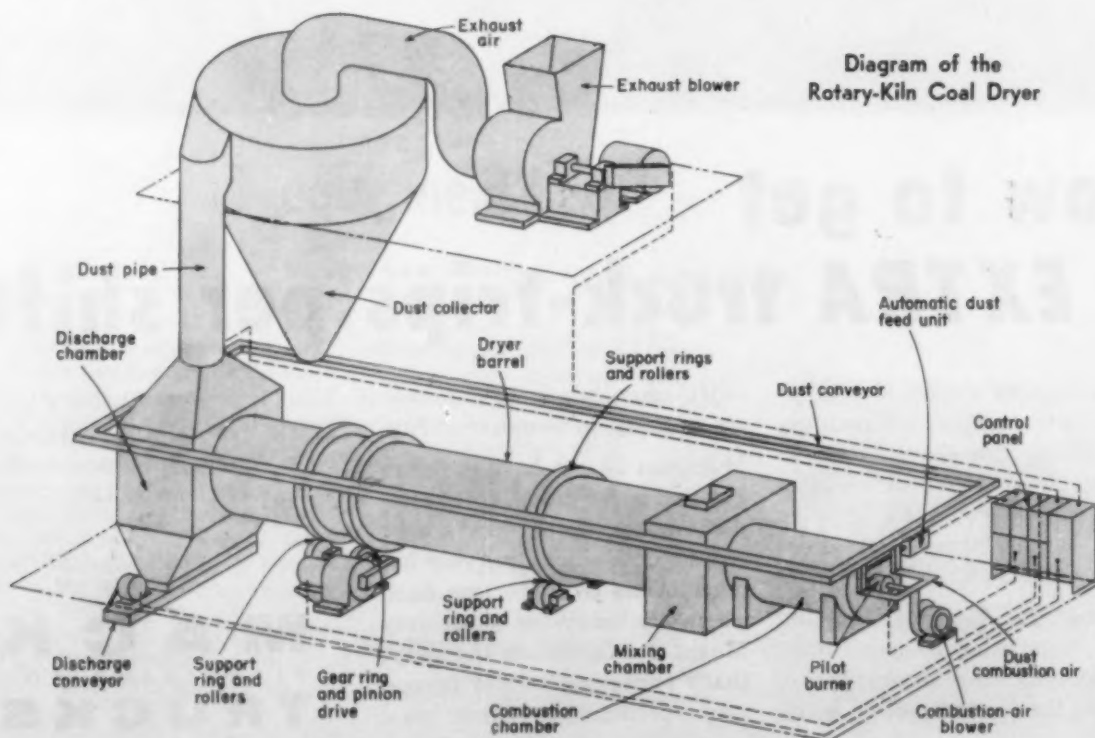


Diagram of the Rotary-Kiln Coal Dryer

Here's how the rotary-kiln dryer performs at Robey Run Coal Co.

A NEW ROTARY-KILN COAL DRYER has increased plant efficiency, lowered operating and maintenance costs, and improved the quality of coal at Robey Run Coal Co., Dola, W. Va. It is designed to handle sizes up to 2 in at a rate of 150 to 180 tph, drop moisture from 15% to 2% and maintain an exhaust temperature of 125 F. Low purchase and installation costs are among the advantages.

The Ruby dryer, manufactured by Ruby Equipment Co., Scottdale, Pa., is designed to dry raw or washed coal. It is completely automatic and features push-button firing of coal dust by a gas pilot light, electronic controls for increasing or decreasing heat as moisture content of coal varies, and a heat-generating process that permits drying coal within 5 min after pilot light is ignited, even after long periods of shutdown.

Preparation and Problems

Preparation at Robey Run, prior to installing the dryer and two air tables, involved stockpiling raw coal in an open area and then conveying it to the plant for screening and crushing. Smaller sizes were separated and oversize crushed. These products were then combined and rescreened. Plus $\frac{1}{2}$ -in was conveyed to a heavy-media plant for cleaning and then to classifying screens for sizing and loading. Minus $\frac{1}{2}$ -in was loaded directly into railroad cars.

Due to consistently high percentages of surface moisture in raw coal, screening $\frac{1}{2} \times 0$ from the crushed product was difficult. Screen blinding prevented good separation. The poor screening caused the plus $\frac{1}{2}$ -in product going to the heavy-media plant to contain large amounts of fines which disrupted the gravity plant operation. The fines also hampered clean-coal dewatering, which resulted in high moisture-content products.

Discharge water from the heavy-media plant contained large amounts of fines which made it impossible to reuse the water. Consumption of magnetite was extremely high, thus increasing the cost per ton of pre-

pared coal and also slowing the cleaning process.

To overcome these conditions the Robey Run Coal Co., in cooperation with W. L. Pritts, consulting engineer, Scottdale, Pa., made a survey of what would be required to eliminate these problems. In addition, the company made plans to increase the recovery of and improve the quality of $\frac{1}{2} \times 0$.

Quality improvement necessitated the installation of two air tables. And since dry cleaning is at its highest efficiency when coal is dry it also was essential to place a dryer in the system.

The question was posed as to where the dryer should be located to eliminate as many of the preparation problems as possible. An analysis proved that if raw coal was dried before it was screened this would solve most of the problems, as follows:

1. Eliminate screen blinding caused by wet coal.
2. Increase recovery of $\frac{1}{2} \times 0$ by improved screening without adding more screening units and by separating fines clinging to coarse coal.
3. Produce a better $\frac{1}{2} \times 0$ product by air tabling dried coal.
4. Reduce the amount of fines going to heavy-media plant, thus gaining greater control over gravity results.
5. Make it possible to reuse discharge water by reducing fines going to heavy-media plant.
6. Reduce the amount of magnetite used in the washing process.
7. Produce plus $\frac{1}{2}$ -in products with minimum moisture by improving the dewatering process.
8. Reduce repairs to chutes and conveyors by minimizing chemical reaction activated by wet raw coal.
9. Increase over-all plant efficiency.

It was necessary to design and construct a dryer that would efficiently dry 2×0 coal containing from 4% to 15% moisture because it was impossible to fine a dryer on the market that would meet these requirements.

Rotary-Kiln Dryer

The rotary kiln design proved to be the most effective method for handling sizes up to 2 in. Success of the dryer is attributed to a redesigned kiln which keeps coal in suspension for the length of time necessary to permit the right quantity of heated air to pass uniformly through the suspended coal to absorb moisture and keep the dried coal far below critical temperature.

The heat-generating problem was solved by adapting a combustion chamber to the kiln and using a gas pilot light to ignite coal dust collected from the drying process. Dust is automatically injected into the combustion chamber in the path of the pilot light. This insures instant firing of coal dust, thus eliminating possibility of explosions.

Dust fed to the combustion chamber is controlled by electronic means and governed by the moisture content of coal being fed to the dryer. This provides a quick method for increasing or decreasing heat in the dryer as the moisture varies and also keeps the exhaust temperature at approximately 125 F. By anticipating moisture content and controlling heat, fuel cost is kept to a minimum.

Coal dust ignited by a gas pilot light produces a higher temperature quicker than any other firing material. Incidentally, the dust used in this process is so fine that it requires practically no ash cleanup and does not produce noticeable flyash. The dryer at Robey Run is operated without scrubbers. The efficiency of burning this dust has shown that operating cost is actually offset by the savings in magnetite.

The push-button firing operation with electrically-ignited gas pilot light enables the dryer to be shut down during idle periods, thus reducing operating cost. Within 5 min after the pilot light is ignited the dryer is ready for drying coal, regardless of the length of shutdown.

Although most preparation plants do not dry raw coal, Robey Run Coal Co. has found that many of the problems involved in preparing a satisfactory marketable coal have been eliminated by so doing.

At FREEMAN COAL . . .

USS Special Steels **keep mining**



reduce breakdowns... equipment on the job



USS Stainless Steel chutes last five or six times longer. With stainless steel chutes, there are absolutely no maintenance problems according to Mr. Garwood of the Freeman Coal Mining Corp. Stainless outlasts other metals five or six times. Coal doesn't clog up the chutes and they effectively resist the corrosion of mine waters.

Stainless Steel de-watering screens are another application where the durability factor of stainless stands out so remarkably. These screens last three to four times as long as any others tried.

USS COR-TEN Steel cars last 100% longer. At the Orient #3 mine, COR-TEN Steel cars last eight to ten years compared with four to five years for other cars. The most serious damage to mine cars comes from corrosion and abrasion. With cars made of COR-TEN Steel, this problem is almost non-existent because they have such a high degree of resistance to both corrosion and abrasion. USS COR-TEN High-Strength Low-Alloy Steel led to remarkable savings in operating costs.

USS "T-1" Steel eliminates breakdowns of shaker cross-heads. Before the introduction of "T-1" Steel for shaker cross-heads and connecting rods, breakdowns were numerous. Repair costs ran high and coal operations were interrupted. USS "T-1" Steel in this abusive application lasts three to four times as long as any other metal tried. This is due to its great strength.

Mr. Thomas L. Garwood, Assistant Vice President of Freeman Coal Mining Corporation, Waltonville, Ill., says, "In our continuous production schedule, we simply can't afford breakdowns, excessive maintenance problems, or inferior equipment which would cause a slowdown."

Freeman Coal has found that the right steels for the right jobs—USS High-Strength Low-Alloy, "T-1" Constructional Alloy, and Stainless Steels—earn more profit dollars because they last longer and keep expensive equipment on the job.

Here are the USS Steels that do more:

USS MAN-TEN Brand—High strength with abrasion resistance and economy. (Minimum yield point 50,000 psi up to $\frac{1}{2}$ " thick incl.)

USS COR-TEN Brand—High strength with superior atmospheric corrosion resistance. (Minimum yield point 50,000 psi up to $\frac{1}{2}$ " thick incl.)

USS TRI-TEN Brand—High strength with toughness and abrasion resistance. (Minimum yield point 50,000 psi up to $\frac{3}{4}$ " thick incl.)

USS "T-1" Brand—High yield strength with impact abrasion resistance, toughness and weldability. (Minimum yield strength 100,000 psi or furnished to 321 min. Brinell hardness.)

USS Stainless—High resistance to corrosion, temperature, pressure, and abrasion.

Each of these steels has a combination of properties that makes it best for specific applications. Our metallurgists will be glad to help you choose the best steels for your job. Call our nearest Sales Office or write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

INDUSTRY MEETING—A Special COAL AGE Staff-Written Report



ME-MMA's Maintenance Idea of the Year Awards

THE MAINTENANCE IDEA OF THE YEAR AWARD was won by Don Lambing (left photo), chief electrician, Mine No. 31, Bethlehem Mines Corp., Nantyglo, Pa. Mr. Lambing won in competition with entrants from two other branches. His idea eliminated the complete gear-case drive and two additional gears from the head drive of the Jeffrey 76AM Colmol. The drives are now directly connected to the armature shaft and protected by one $\frac{1}{4}$ -in shear pin on the top head drive and by two $\frac{1}{4}$ -in shear pins on the bottom drive. The two gears removed from the head drive permits better alignment of the armature shaft and drive gear case for the universal drive shafts. The results are increased penetration and better stability to the machine, reports Mr. Lambing. Other advantages include savings of $2\frac{1}{2}$ hr when changing armature or motor, and gears which were eliminated can no longer give trouble, thus eliminating a possible replacement cost of approximately \$4,000.

Runners-up were H. R. Morrison (center photo), general foreman, machine repair shop, Rochester & Pittsburgh Coal Co., Ernest, Pa., and the maintenance force of the Wyatt Seanon Coal Co. Ken Ruffner, supervisor-maintenance (right), accepted the award for the Wyatt Seanon group. Mr. Morrison's contribution eliminated the interior bar swing jacks, swing chains and sheaves on the 3 JCM loader. These were replaced by 14 BU swing jacks mounted on the outside of the machine using swing ropes mounted to the top turntable. The results have decreased downtime and maintenance cost.

The maintenance force at Wyatt Seanon repositioned the auger screw on the 11RU bugduster so that it extends 2 in outside the bugduster tube. This change increased removal of dust by 25%.

The selection committee for the Maintenance Idea of the Year included Merle Campbell, William Kegel, W. E. McClain, Michael Duda and Frank Valla.



C. S. CONRAD, ME-MMA president and maintenance superintendent, Mountaineer Coal Co., Monongah, W. Va.

The President Speaks . . .

"LONG RANGE PREDICTIONS for power requirements in industry and domestic markets show tremendous increases. Coal is expected to provide the bulk of these energy demands. To meet these demands the coal industry needs more mechanization—equipment capable of high production rates. Such equipment must be efficient and it also will be more complex. Successful performance of these new machines will depend in a large measure on the capabilities of maintenance personnel assigned to service them.

"To keep pace with new developments, we in maintenance cannot afford to be complacent but rather should seek out every opportunity to keep abreast of all that is new.

"ME-MMA is a medium designed to do such a job. It is, 'Dedicated to the furtherance of safety and efficiency in mining through better maintenance of equipment'.

"ME-MMA today is a going organization on the strength of the support given it by a small percentage of its total membership. Its growth is unlimited but it will be dependent upon each member taking an active part in planning for the future."



TECHNICAL SESSION—Howard W. Davies (left), Anaconda Wire & Cable Co.; W. J. Marsh, USS Corp.; James A. Harmar, Mountaineer Coal Co.; J. S. Johnson, Westinghouse Electric Corp.; and C. S. Conrad, Mountaineer Coal Co.



BRANCH AWARD to Barnesboro group is presented to George T. Atkins, Barnes & Tucker Co., by Alex E. Molinski.

Mining Electro-Mechanical Maintenance Association meets to discuss . . .

New Ideas in Maintenance

MAINTENANCE CONTROL, heavy-haulage maintenance and testing electrical equipment highlighted ME-MMA's 7th annual technical session held at the Summit Hotel, Uniontown, Pa., Sept. 26. The one day meeting—ME-MMA's 11th anniversary—was attended by 238 electrical and mechanical experts, supervisors and manufacturer's representatives.

Howard W. Davis, Anaconda Wire & Cable Co., presided at the afternoon session which included an address by the president, presentation of technical papers and announcement of Branch Award and Maintenance Idea of the Year Award. Awards were announced by Alex E. Molinski, Bethlehem Mines Corp.

Following are abstracts of papers.

Maintenance Control, W. J. Marsh, superintendent district maintenance, US Steel Corp., Frick Dist., Uniontown, Pa.

"The terms maintenance programs and preventive or productive maintenance often are presented in a package that is staggering in scope or too complicated in concept. This should not be. Simplicity is of prime importance. Following the thought of simplicity or familiarity, it is the belief that there is no one best method of reducing maintenance costs. Each location must be approached separately and the general program tailored according to the following considerations: plant organization, plant size,

policy wishes of plant management, and the type and condition of equipment in use and the controls and methods presently used."

The phases or functions of a maintenance organization are as follows:

1. Emergency section repairs.
2. Productive maintenance.
3. Unit replacement.
4. Overhaul.
5. Shop activities and outside contracts.

The complete maintenance program also includes auxiliary functions, such as, maintenance procedures, material testing and basic records.

Mr. Marsh described one method for collecting data that provides information of value. Specifically, this information includes tonnage and production delays by individual machine. Source of information is from a shift report which is filled out by the assistant mine foreman. The report goes to the general mine foreman and then to the general maintenance foreman. Code numbers are assigned to delays by the maintenance foreman. These numbers are then posted on cards. One card denotes tonnage attributed to each machine while the other is used for posting production delays. From this point on all processing, collecting and posting of data is accomplished by IBM machines.

In conclusion Mr. Marsh stated that simplicity was the key to any maintenance

program. A maintenance program should be simple enough to allow application of the basic rules of management, i.e., to plan, to act and to judge.

Heavy Haulage, James A. Harmar, assistant superintendent, Mine No. 9, Mountaineer Coal Co., Monongah, W. Va.

After a description of the haulage system at No. 9 mine, Mr. Harmar discussed the steps taken by Mountaineer Coal Co. to reduce maintenance costs and improve efficiency of the over-all haulage system. These steps included:

1. Proper installation and maintenance of haulage track.
2. Setting up a preventive maintenance program for locomotives, mine cars and trolley wire.
3. Improvements in the design of mine-car wheels and truck assemblies.

The No. 9 mine has 13.4 mi of 44-in gage track. Mainline track is 3.6 mi consisting of 85-lb steel on wood ties and ballasted with limestone chips on graded bottom. Panel track is approximately 7 mi long and consists of 60-lb steel on wood ties, ungraded bottom, and is ballasted with slate and coal. Loaded and empty section loops make up the remainder of the haulage system.

Haulage equipment consists of 17-ton 8-wheel mine cars 27 ft long 6 ft 10 in wide and 4 ft high, and three 30-ton, one 50-ton and four 15-ton locomotives,

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plus several small units ranging from 3 to 12 tons.

Track maintenance has been speeded up by employing a track tamper manufactured by the J. H. Fletcher Co., Huntington, W. Va. This is a self-propelled unit equipped with four air-actuated tamping bars.

Installation of Mack switch-point protectors has extended switch-point life by as much as 300% and reduced wrecks.

The use of a yard-type MC Meco flange lubricator has reduced rolling friction and cut wheel flange wear 80%.

The preventive maintenance program for locomotives has resulted in only one armature change in the past 4 yr. Locomotive trucks last from 2 to 3 yr.

Mine-car improvements consisted of providing a way to grease the center truck bearings, setting up a lubrication schedule and correcting wheels that were not parallel. It was found that the wheel base of the two wheels on one side of the truck was off 1/4 in. plus or minus, compared to the opposite wheels. Misalignment tolerance are now held to plus or minus 0.010 in.

"The most important items in improving our haulage system, not only from a maintenance standpoint but also from an efficiency and economic view, are the flange lubricator and switch-point protectors."

Testing to Prolong Life of Electrical Equipment, J. S. Johnson, manager of renewal parts and maintenance engineering large rotating apparatus, Westinghouse Electric Corp.

"The economics of maintenance efforts ideally should be justified on the basis of the relation between maintenance inspection and repair expense and the cost of service failures. Also, a more intangible factor is an economic evaluation of the increased service reliability which results from an effective maintenance program."

The principal economics that may be expected from a maintenance program are those which result from:

1. The ability to coordinate maintenance efforts so that needed work may be accomplished with minimum downtime.

2. The ability to plan in advance and arrange manpower requirements on an orderly basis rather than resorting to expensive crash programs.

3. The capitalized value of the increased availability of the equipment.

Some of the methods available for evaluating large motors and generators which were discussed by Mr. Johnson included visual inspection; ground insulation tests, such as, insulation resistance tests and dielectric absorption tests; low-voltage AC characteristics; DC voltage leakage tests, including conductor insulation tests, and impedance tests.

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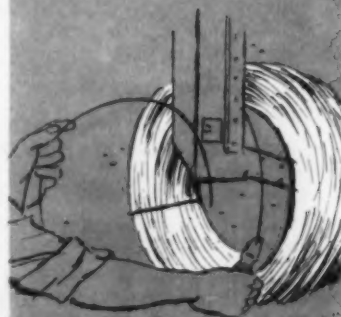
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WATER CLARIFICATION—Edwin F. Koppe (left), Pennsylvania Bureau of Topographic & Geologic Survey; R. H. Oliver, Dorr-Oliver, Inc.; H. E. Mauck, Freeman Coal Mining Corp.; J. J. Reilly, Jones & Laughlin Steel Corp.; R. L. Llewellyn, Eastern Gas & Fuel Assoc., and W. E. Hess, Jones & Laughlin Steel Corp.

Society of Mining Engineers of AIME meets in Bedford Springs to discuss . . .

Water Clarification, Mine Pollutants

COMPREHENSIVE PRESENTATIONS of coal's past, present and future position in the fields of water clarification and mine pollutants highlighted the joint Coal-Industrial Minerals Conference held at the Bedford Springs Hotel, Bedford Springs, Pa., Sept. 24-26. Over 225 members and guests gathered to hear talks on these two important topics.

Water Clarification

The first session, Thursday afternoon—under co-chairmen H. E. Mauck, Freeman Coal Mining Corp., and W. E. Hess, Jones & Laughlin Steel Corp.—covered water clarification. Following are abstracts of the papers.

The Application of Flocculants to the Clarification of Coal Washery Waters, R. H. Oliver and K. C. Lindstrom, Dorr-Oliver Inc., Westport, Conn.

"A thorough understanding of the field of flocculation today and a continued awareness of tomorrow's developments are the keys to the most economical solution to your water clarification problems."

The installation of equipment for the complete clarification of coal washery waters—approximately 1,000 ppm suspended solids—can be economically justified on the basis of one or a combination of three results.

1. Greater flexibility in the control of ash content of the fine-coal product.

2. Simplification of the control of washery operations through elimination

of slime-laden recirculation water.

3. Elimination of stream pollution due to slime laden bleedoff water.

Location of thickeners and selection, preparation, testing and cost of flocculants were discussed by Mr. Oliver.

Five typical flowsheets using thickeners for water clarification and coal flocculation data sheet which included type of flocculant and manufacturer, range of pH effectiveness, method of preparation, strength of solution, method of addition, commercial dosage, price per pound and additional information, were used by Mr. Oliver in his discussion.

Water Clarification System at Wharton No. 2 Preparation Plant, R. L. Llewellyn, preparation engineer, Eastern Gas & Fuel Associates, Pittsburgh, Pa.

Water clarification and solids recovery from a Baum jig-Deister table plant were combined into one problem at Wharton's No. 2 plant which has a capacity of 6,000 tpd. This step was necessary to enable the company to comply with stream pollution regulations.

Tests were made of the plant bleed to establish the capacity of the equipment involved. A combination of cyclones, thickeners and filter systems were installed to classify fine-coal solids and to obtain clarified water by flocculation for reuse in the washer circuit. A series pumping circuit was installed to waste the extremely fine solids to a disposal area nearby.

Froth cells are to be added to treat 28x0 mesh from the clean coal screens and the overflow from 24-in cyclones. The product from the two slurries—2,200 gpm with 8% solids—will be directed to the present sump where it will be pumped to a battery of froth cells. Clean coal from the cells will be sluiced to the filter and the refuse discharged into the present piping feeding the 75-ft thickener.

Maintenance of Water Clarification Equipment, J. J. Reilly, coal preparation superintendent, Jones & Laughlin Steel Corp., Labelle, Pa.

A description of the preparation plant and size of particles in the feed due to continuous mining and the need for a good quality metallurgical coal preceded Mr. Reilly's talk on maintenance. He then listed the following suggestions which he has found lead to better maintenance of preparation equipment.

1. Minimize solids in recirculating water.

2. Provide extra pump capacity to allow for wear.

3. Adjust pumps frequently.

4. Provide close maintenance to reduce downtime, particularly at vacuum filters.

5. Constant attention must be given to life of materials.

Some Geological Factors Affecting the Upper Freeport Coal and Its Qualities, Edwin F. Koppe, Pennsylvania Geological Survey, Harrisburg, Pa.



MINE POLLUTANTS—Henry Hebley (left) consultant; William Leathen, Mellon Inst.; H. E. Mauck; Ernest P. Hall, Consolidation Coal Co.; S. A. Braley, Mellon Inst., and L. E. Morgan, Pennsylvania State Sanitary Water Board.

The Upper Freeport coal in the Freeport and New Kensington quadrangles varies from a bony streak to a thick coal deposit often exceeding 90 in. in the double or thick Freeport. Distinctive basal partings, a central bone layer and a cannelloid top bench may be present.

The appearance of a sandstone roof, sandstone rolls and bony coal at the top of the main coal bench can be anticipated in thin Freeport areas when basal partings are absent. When the two basal partings are present, a shale roof is normal. These effects are correlated with the original topography upon which the coal was deposited. The original depositional high areas tend to coincide with present structural highs.

Preliminary data indicate that coal quality, in part, is affected by the depositional setting. In "high" areas, a tendency exists for the main coal bench to contain higher percentages of fusain, mineral matter and other petrographic components. Within limits somewhat higher ash fusion temperatures appear to correlate with paleotopographic highs.

Mine Pollutants

Co-chairmen for the Friday morning session were Henry Hebley, consultant and H. E. Mauck, Freeman Coal Mining Corp.

Mine Acid Control, S. A. Braley, administrative fellow, Mellon Inst., Pittsburgh, Pa.

Because of the many variables involved there is no known universal, economical or practical method for prevention of acid formation or for treatment after formation. "There are, however, engineering procedures that may be used in specific cases to prevent or decrease the pollutional properties

of mine discharges," Mr. Braley said.

"Much has been accomplished in abatement of acid discharges in operating mines, although the active operations present only a fraction of the entire problem.

"The most serious problem is the abandoned mine. Almost as troublesome are the abandoned areas of operating mines. Operating areas of deep mines and strip mines are a minor factor. While procedures proven effective in specific cases cannot be utilized as blanket requirements for abatement, much improvement can result from greater vigilance on the part of the operator with the assistance and responsible cooperation of enforcement agencies."

Mr. Braley further stated that, "The natural oxidation of sulfuric material is the initial reaction responsible for the acid properties of mine discharges. Secondary reactions of the initially-formed acid and acid salts with the geologic strata can produce mine discharges of variable composition from high acid content to high alkali. The volume of water determined by the area of excavation and the specific aquifers severed or the water-bearing strata that are exposed."

The Influence of Bacteria on the Formation of Acid Mine Drainage, William W. Leathen, head, Microbiology and Microscopy Section Research Services, Mellon Inst., Pittsburgh, Pa.

Most bituminous coal mine effluents are highly acidic and contain, along with ions, high concentrations of ferrous iron. The acid is sulfuric and the iron is present as the sulfate. Both of these are the oxidation products of iron sulfides (FeS_2) which are present in the form of pyrites, marcasites or other sulfuritic minerals.

Bacteria have been isolated from bituminous coal mine effluents which influence the formation of acid mine drainage.

The rate of chemical oxidation of the sulfuritic materials—sulfur balls, marcasite and pyrite—associated with bituminous coal seams is dependent upon the crystalline structure of the compound. The amorphous sulfur-ball material has the greatest reactivity while the dense pyrite is inert. Marcasite is moderately reactive. Bacteria accelerated the rate of acid formation in the same order as the chemical reactivity of the compounds, the greatest increase in acidity being produced in substrates containing sulfur-ball material. There was no increase in the acidity produced from pyrite.

The Success and Weakness of Pennsylvania Regulations on the Formation and Control of Acid Mine Drainage, L. E. Morgan, Pennsylvania State Sanitary Water Board.

A better understanding of the problem of acid mine drainage can be achieved by continued research and cooperation of scientist, coal operators and the public. Cooperation was stressed by Mr. Morgan as being one of the most important factors in the abatement of stream pollution.

The sanitary water board makes about 450 inspections per month to determine the effectiveness of operators methods of preventing stream pollution and to make sure that operators are complying with state regulations.

"We do not have an answer to the problem of acid mine drainage," said Mr. Morgan, "But with cooperation we may arrive at some suitable solution."

The Pennsylvania State Sanitary Water Board cannot regulate discharge into polluted streams. On the other hand, the Board cannot permit discharge of any acid mine drainage into clean streams.

Hutchison Mine: A Problem in Coal-Mine Drainage, Ernest P. Hall and John L. Rozance, Consolidation Coal Co., Pittsburgh, Pa.

The individual water problems of the Hutchison mine are not greatly different from the water problems encountered in many mines in the Pittsburgh area. However, it is unique to have such a range of water problems in one mine. This resume of water drainage conditions is presented to illustrate some of the problems and difficulties caused by water drainage in some coal mining operations and to point out that these problems must be considered and overcome if coal is to be mined.

Mr. Hall used a series of slides to show and discuss the various conditions of the mine drainage problem at the Hutchison mine.

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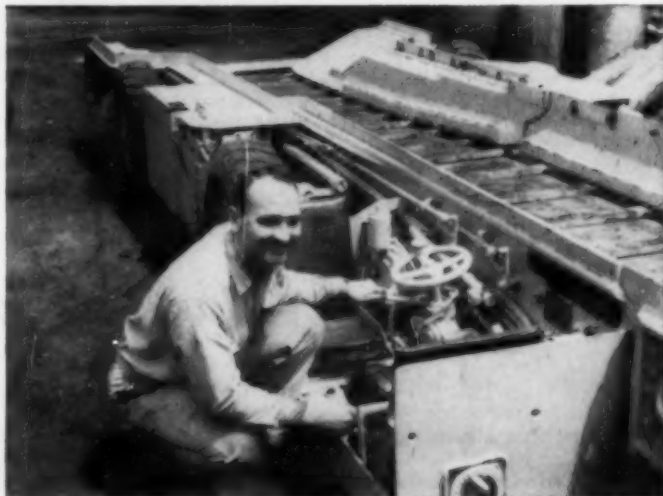
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DEEP AND STRIP POWER—Session Chairman R. M. Buckeridge (left), Goodman Mfg. Co.; J. J. Laffin, Dominion Steel & Coal Corp., Ltd.; F. R. Hugus, Joy Mfg. Co.; D. E. Barber, Bucyrus-Erie Co., and D. E. Hamilton, General Electric Co.



SPECIAL SERVICES—R. S. James (left), USBM, session chairman; W. A. Hodgson, Westinghouse Electric Corp.; W. F. Loranger, General Electric Co.; John A. Buss, Reliance Electric Co., and Chairman of Mining Section, AIEE, and A. L. Reed, Allen & Garcia.

Mining Section of AIEE explores . . .

Electric Services for Coal

Open-pit distribution of power, equipment developments, preparation-plant power systems, among major topics at Chicago meeting.

USE OF X-RAY techniques to sample certain elements in a stream of materials, distribution of power in submarine mines of Nova Scotia and good motor maintenance procedures also were program features at the two technical sessions conducted by the AIEE Committee on the Mining Industry, at Chicago, Ill., Oct. 15.

Abstracts of the eight technical papers are as follows:

A Review of Open-Pit Mine-Power Distribution Practices, by R. B. Bennett, Cincinnati, Ohio, and M. A. Neslin,

Schenectady, N. Y., applications engineers, General Electric Co. (Read by D. E. Hamilton, General Electric Co.)

Early in 1958, the first of a number of very large stripping shovels was placed in service at a distribution voltage of 6,900 V. The need for higher than 4,160 V had been evident from the fact that connected power on these new large shovels had been more than doubled over the connected power of the previous largest stripping shovels, and maximum horsepower peaks in excess of 7,000 hp were anticipated. In addition, it was desired to transmit the

maximum power through trailing cables for distances as great as 15,000 ft from the semi-permanent substation to the shovel. To meet these requirements and still maintain acceptable values of voltage drop at maximum load, the distribution voltage level of 6,900 V was chosen. Power system performance was simulated on an analog computer and it was confirmed that the 6,900 V voltage level was necessary and adequate.

Since excavators are portable and move quite frequently, it is difficult and impractical to try to control the resistance of frame-to-earth contact. Because of the necessity for men to simultaneously contact shovel frames and earth during operation, repair and maintenance, the principle of limiting frame-to-earth voltage was adopted.

It should be noted that neutral-resistance grounding is a safety mechanism but it does not provide protection unless the metallic-ground circuit is continuous. The metallic-ground circuit does not provide inherent indication of continuity and for that reason a ground continuity check circuit is recommended. The purpose of the ground continuity check circuit is to indicate the continuity of the metallic-ground circuit and to prevent operation unless the ground circuit is complete.

One form of ground continuity check which gives continuous indication of ground circuit continuity, employs a DC current (usually obtained from rectified AC) flowing through an insulated ground wire and returning on the normal ground wires to complete the circuit. In series with the insulated ground wire is a ground check relay with contacts in the undervoltage circuit of the circuit breaker. Should the ground circuit become discontinuous, the relay will drop out.

Feedback Control for Power-Shovel Generator Excitation, by D. E. Barber, electrical engineer in charge of electrical engineering department, Bucyrus-Erie Co., S. Milwaukee, Wis.

Twenty-five years ago, the mining industry greeted enthusiastically the advent of a control system designed to overcome many of the difficulties encountered in the control of large Ward-Leonard equipped electric excavators. Over the years, this control, centered about the rotating amplifier, has become the standard of excellence for these machines, affording the user distinct advantages over other types of shovel drive systems.

In the eyes of the design engineer, the rotating type of control produces essentially a drive with torque control. That is, the operator controls the available stall torque, while the load effectively controls the drive speed. To the average operator, torque is a nebulous quantity, not being apparent to

him except through its effect on drive speed. The only true measure of performance which is visible to the operator is drive speed.

Thus it is that although torque control drives have proved to be quite adequate, a need has existed for a drive possessing speed control characteristics, wherein the operator selects a desired speed, and the control precisely and automatically maintains that speed up to the safe torque limit of the machine.

The term "feedback control" is derived from one of the basic connections of a closed loop regulating system, wherein a sampling of the controlled quantity is "fed back" to the controlling device to be used as an auxiliary signal. The voltage regulator presents a good illustration of the principles involved, and is also the foundation of the speed control system so desirable for many shovel drive applications. Field application of this control has illustrated three additional features concerning performance. First, the machine appears much "smoother" in operation since at light loads the speed change between the master switch off position and the first point of control is considerably less than with rotating amplifier control. With the new characteristic, only 5 to 15% of maximum no load speed is available in first point, whereas with rotating control 70 to 80% was forthcoming. The sudden large excursion gave the rotating control equipped machine the appearance of being somewhat hypersensitive. In this regard the life of the wire ropes on the hoist and crowd motions is no small consideration. It is obvious that a smoother application of power will increase the operating life of these ropes.

Of equal importance is the fact that with this system the operator has for the first time complete control over his performance yardstick; drive speed. A significant step has been made toward bridging the gap that exists between the mind of the operator and the shovel dipper. Yet that gap persists and there remains much to be done to diminish it. Feedback systems, the basis for present day precision controls, has potentially opened the door for the mining industry to the automated world of tomorrow.

Mining With AC Power in Dosco Mines, by J. J. Laffin, electrical engineer, coal operations, Dominion Steel & Coal Corp., Ltd., Sydney, N. S.

Longwall mining is the common system as 85% of the coal is extracted by this method. This system was found necessary for mining at great depths due to the heavy overburden, weak roof and pavement which does not permit pillar extraction. The longwall system differs from the room and pillar system in that the face is 500 ft or longer. Advance is made by taking a

slice of 5-ft width from the length of the face during an 8-hr shift.

The characteristics of the power supply underground are 6,600 V, 3-phase, 60-cycle, ungrounded delta system. It is distributed at this voltage through three core cable of either No. 4/0 or No. 1/0 AWG.

Electric power at 6,600 V is carried within 1,000 ft of the coal face in a room-and-pillar operation and within 400 ft of the coal face in a longwall operation.

Remote control of mining equipment for use at or near the coal face is utilized wherever possible because:

1. It removes all normal switching from the coal face with the exception of the control circuit which is an intrinsically safe circuit and therefore not hazardous;

2. The cable is alive only when the machine is operating; and

3. The limitations imposed on controllers by the limited dimensions of the machine are completely overcome since the starter is located in a roadway 400 ft from the working face where space is not limited.

Power is supplied to the Dosco Miner through a No. 2/0 AWG and a No. 6 AWG trailing cable made up of 75-ft sections fitted with molded-type cable couplers. Electrical interlocking of the cable couplers and remote operation of the switch-gear are achieved through the use of the pilot wires and ground wire in the trailing cable.

Prior to the production shift the individual lengths of cable comprising each circuit are coupled together to interconnect the remote controlled switch units and the Dosco Miner. At the beginning of the production shift the circuit breaker of each of the switch units is closed permitting the operator of the Miner to close the linestarter of each by operating the start-stop switches on the Miner controller. The Miner starts down the face, cutting and loading until it has progressed 75 ft along the wall. Power is then cut off from the machine through operation of the start-stop switches and one length of each size cable is disconnected and left in place. The miner is coupled to the remaining cables which are connected to the roadway switch units and moves another 75 ft along the coal face.

Remote Control of Underground Mining Machinery, by Frank R. Hugus, chief electrical engineer, Coal Machinery Div., Joy Mfg. Co., Franklin, Pa.

It is not the intent of this paper to suggest a compromise with safety or a backing away from the best known safety practices. It is the intention of this paper to demonstrate that safety can be secured through the skillful application and use of certain electrical

control devices that are used in industries outside the mining field.

The customary use of face machines dictates that where a machine goes, a man must go also. This forces mine management to provide the same degree of safety for the machine as is provided for the operator. Since the machine is considerably larger than the operator and far less maneuverable, it follows that the cost of providing the machine with the same high level of safety necessary for an operator unnecessarily increases the overall cost of safety in a mine. Thus it is desirable to maintain or improve the present high level of safety for the operator, yet to provide a means for operating the machine that will not demand the extension of this high level of safety into the area where the machine operates. This can be achieved quite easily by the use of remote control.

All coal mining machines intended for face operation must be permissible. Ordinarily this permissibility is achieved by fitting the machine with compartments designed to contain internal explosions of methane and air mixture. Such a compartment would be entirely too heavy for the remote control station, so the desired lightweight design should be based on intrinsically-safe circuits in the remote control station. A type of remote control which has proved practical and met a need in the mining industry was developed by Jones & Laughlin Steel Corp. and is described in the August, 1959, issue of *Coal Age*.

Within the last two years the Joy Mfg. Co. announced its 'Lectronic Sentry which provides ground wire protection for direct current machine, yet allows these machines to operate with only a 2-conductor trailing cable.

In addition to offering the advantage of replacing the ground wire in a DC machine trailing cable, this 'Lectronic Sentry can be used as a building block to achieve various remote control functions.

Development work is being done by Mine Safety Appliances Co. on a continuous methane monitor which will be connected to this 'Lectronic Sentry so that a machine will be shut down automatically at the safety circuit center when the methane concentration in the atmosphere surrounding it reaches a dangerous level.

Over a year ago a Joy Mfg. Co. boring type continuous miner was built to be completely controlled from a remote control station.

Electrical Systems for Modern Coal Preparation Plants, by A. L. Reed, electrical engineer, Allen & Garcia Co., Chicago, Ill.

One of the measures of the success or failure of a coal preparation plant is how

well it operates the first two weeks. A large part of this responsibility falls on the shoulders of the electrical engineer. He must keep the electrical outages to a minimum, give the maximum protection to the mechanical equipment and by proper interlocking keep the spills to a minimum.

The application of motors to belt conveyors in many plants leaves something to be desired. In some cases the type of motor is determined by size, which is not the controlling factor. If two belts are compared having the same characteristics except one is twice as long as the other, the belt should be twice as strong, the mass of the load twice as great, the motor twice as big and its ability to start the load is twice as great. The two belts on a percentage basis should be identical.

The two factors which should be considered are—does the motor have the thermal capacity to start the load and will the belt be overstressed on starting.

The ability of a motor to start a load is normally determined by how long it requires the motor to bring the load up to speed. The factors which determine this are the area between the speed torque curve of the motor and the speed torque curve of the load, and the total inertia of the system. If a motor requires

too long a time to come up to speed, the rotor conductors will be overheated and the motor damaged.

To sum up, the hard belts to start are fast, flat belts. The belts which are easy to start are steep, slow belts.

Progress Toward On-Line Analysis of Raw Materials, by Dr. W. F. Loranger, technical adviser to instrument sales, X-Ray Dept., General Electric Co., Milwaukee, Wis.

Perhaps the greatest innovation in the field of x-ray analysis is the transition of instrumentation from the laboratory (where it has had few, if any, equals as an analytical instrument) to a place on the production line as both an analytical and process control unit.

With the increasing demands on industry to automate, a natural need exists (particularly in the processing industries) for an on-line sensor capable of rapid, continuous chemical analysis.

Such an instrument is now available from the X-Ray Department, General Electric Co., and is marketed under the name X-Ray Emission Gage (XEG).

The XEG is capable of gaging and analyzing up to 5 elements with a reference, or 6 elements without a reference, from magnesium, atomic number 12, upward through the periodic chart. It is

designed for either on-line process control or production and quality control of a continuous flow of materials in the form of sheets, wires, rods, dry or moist powder, slurry liquids, gases or individual samples of any of the aforementioned.

The equipment consists of two major components—a measuring head and the electronic cabinet.

There is apparently little or no limitation in the area of application for such on-line sensor instrumentation. This now provides an all important initial step in automation in which elemental chemical analysis may serve as a control basis.

Installations at present can only be talked of in general terms because of proprietary interests of the companies concerned. Such a gage has been operating on a copper tailings line, continuously monitoring the percent copper in the tailings being dumped in the tailings pond. Those familiar with the economics involved in the refining of copper know that this is critical information.

Areas of further immediate interest and application certainly appear to be in metals smelting, taconite production and perhaps in grading of coal at the mine.

Electric Motor Maintenance and Field Testing, L. L. Lipanye, electrical engineer, Reliance Electric & Engrg. Co.,

NEW easy way to recover roof bolts with **SIMPLEX**

TRIP POST JACK No. M279

- 24" Rack Bar Travel
- High Strength Aluminum Alloy Column and Castings
- Light weight — 72" min. height, weighs only 36 lbs.
- Sizes for all seam heights available



SAFE, EASY-TO-USE...

Two men can recover
350 bolts per day by
using it as follows . . .

Place a Jack alongside each of the first row of bolts closest to the face. Raise to the roof to provide temporary support. Remove bolts by hand or pneumatic wrench. Stand 25' or more away and pull on a rope attached to the Jack trip lever which collapses the Jack. Move Jack to position under the next row of bolts and proceed as previously.

SEE YOUR DISTRIBUTOR, or write
TEMPLETON, KENLY & CO.
2501 Gardner Road, Broadview, Illinois



Cleveland, Ohio. (Read by John A. Buss, Reliance Electric & Engrg. Co., and Section Chairman).

A sound motor maintenance program has a dual objective of: (1) servicing motors in such a way as to assure minimum downtime, and (2) determination of motor condition at periodic intervals, to head off major motor troubles.

NEMA, AIEE, and ASA standards limit permissible variations from the rated operating conditions of standard AC polyphase induction motors. The principle variables are listed here:

1. Voltage—Standard voltages are 110, 208, 220, 440, 550, and 2,300 V. Tolerance on voltage is $\pm 10\%$ with rated frequency.

2. Frequency—Tolerance is $\pm 5\%$ with rated voltage. A higher frequency results in better power factor, decreased locked rotor torque, and increased speed.

3. Combined Voltage and Frequency—Tolerance is $\pm 10\%$, provided that frequency variation is within $\pm 5\%$.

4. Speed—Variation in slip shall not exceed $\pm 20\%$, measured at rated voltage, frequency, and load, at an ambient temperature equal 25 C.

5. Service Factor—For 3 hp and up, all general-purpose and other continuous-duty motors with a 40 C rated temperature rise have a service factor of 115%, operating at rated voltage and frequency. This means that these motors may be operated continuously at 115% of the nameplate rating without injurious heating although the nameplate rise may be exceeded.

Standards have also been established for DC motors. In the discussion which follows are included some of the most common variables, with limits that apply:

1. Voltage—The usual nameplate voltages are 115 or 120 V, and 230 or 240 V. Other common nameplate voltages are 125, 250, and 500 V. Tolerances on these voltages are $\pm 10\%$, unless otherwise specifically given.

2. Speed—The variation in speed due to load change from full-load to no-load (operated within the rated speed range) should be approximately as given in Fig. VI. Tolerance of $\pm 5\%$ usually applies.

3. Overload Capacity—A standard DC motor is capable of carrying a minimum of 150% of the full-load current at base speed and rated voltage for one minute, throughout the rated speed range. Refer to the manufacturer's instructions for other overload conditions.

4. Service Factor—All general-purpose and continuous-duty motors having a rated temperature rise of 40 C have a service factor of 115%; that is, they can operate continuously at 115% of rated load at rated voltage and speed.

Portable Silicon Rectifiers for Mining

Service, by W. A. Hodgson, R. G. Clark and P. H. Westernmyer, Westinghouse Electric Corp., Pittsburgh, Pa. (Presented by Mr. Hodgson).

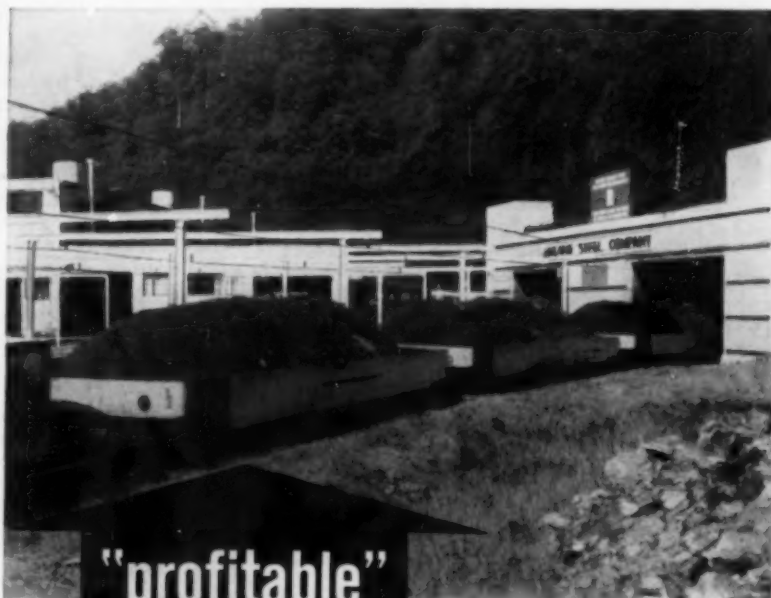
Portable silicon rectifiers for mining service are relatively new starters in the field of converters used for supplying DC current for underground haulage and face machinery. In 1937, mercury-arc units were introduced, and there now exists 1/4 million KW capacity in 1,000 of these converters in the United States.

Recently a new member was added to the list—the silicon semi-conductor recti-

fier. In the United States, at present, 4,000 KW is the total capacity in these newer units installed or on order.

Principal advantages of the silicon rectifier are (1) efficiency is high; (2) coolants (other than air) are not required; (3) the fan is the only moving part; (4) maintenance is low; (5) cost is low.

Non-regulated models may be preferred by most operators, but where regulation is required, it can be provided by the addition of a third car to carry the required equipment. The non-regulated model is installed on two cars.



**"profitable"
mine cars
vs.
"usable"
mine cars**

There is a big difference between "usable" mine cars and "profitable" mine cars. One of the greatest hidden risks in coal haulage today is the high cost of retaining cars that are no longer profitable but still usable.

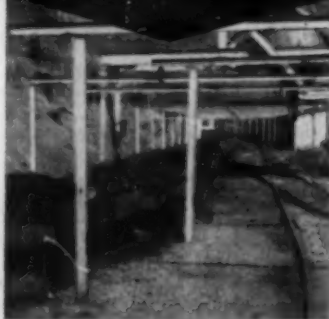
Illustrated on this page is a case in point. Inland Steel Company's Wheelright Mine discarded its still usable 4-wheel cars (lower left) in favor of Differential's 8-wheel cars (above) and experienced—according to their own figures—a 33% reduction in hauling costs!

Differential's patented "axleless" truck design produces greater cubic capacity for any given length, width and height mine car than any other make. Other well known, superior characteristics of Differentials add substantially to the savings.

Let Differential help you map out a profit-promising replacement program starting with an in-the-mine survey. Write today. Don't delay longer!



Trip of 4-wheel mine cars of the type discarded by Inland. Usable? Yes... Profitable? No!



Major themes at 67th Annual Meeting of Illinois Mining Institute:

New Technical Developments, Coal Trends In Illinois

Heavy-media cyclones, auxiliary ventilation, AC power underground, roof-bolt tension indicators and trends in stripping and direct reduction processes are discussed at Springfield meeting of industry officials.

DEVELOPMENTS in the application of auxiliary fans in the deep mines of Illinois was the leadoff topic for review and discussion at the 67th annual meeting of the Illinois Mining Institute at Springfield, Ill., Oct. 16. Following speakers on the one-day program described the cleaning of fine coal in heavy-media cyclones, the application of special lock-washers as roof-bolt tension indicators and the advantages of modern substations for underground installation in AC-powered mines. The future of stripping in Illinois and the present status of direct reduction of iron ore also were in the limelight at the convention which drew more than 300 registrants.

At the business session, members of the institute elected H. C. McCollum, vice president—underground operations, Peabody Coal Co., St. Louis, Mo., to the office of institute president for the coming year, succeeding A. G. Gossard, vice president, Snow Hill Coal Corp., Terre Haute, Ind. Stuart Colnon, president, Bell & Zoller Coal Co., Chicago, Ill., was elected vice president, and George M. Wilson, Illinois Geological Survey, Urbana, Ill., was reelected secretary-treasurer.

Chairmen of the technical sessions were H. R. Stelzriede, chief coal inspector, Freeman Coal Mining Corp., Waltonville, Ill., and B. R. Gebhart, vice president—sales, Freeman Coal Mining Corp., Chicago, Ill. Abstracts of the technical papers are as follows:



Roof-Bolt Tension Indicators,
Jack A. Liddell,
vice president,
National Lock
Washer Co.,
Newark, N. J.

A number of test installations of spring washers between bolt heads and roof plates have been made to assess the value of these inexpensive washers in providing

a visual indication of bolt tension. The washers are conventional lock washers employed for years in railroad work. The split washer closes at a force of 6,500 lb, thus making it possible for a roof bolter to see that he has established that much tension in the bolt. Any relief of tension in the bolt permits the washer to reopen, providing a visual indication of the loosening. As a matter of fact, the washer exerts its own force upon opening to preserve some of the tension in the bolt.

Low cost is a big feature. Unit cost is about 7c per washer, making it possible to consider the installation of an indicator with each bolt. Furthermore, the principle is easily understood. The washers are made to material and quality specifications demanded by the railroads.



Dutch State Mines Heavy-Medium Cyclone System,
by W. C. McCulloch,
manager of
preparation,
Roberts & Schaefer
Co., Chicago, Ill.

We have learned to visualize the forces at work within the thickening or classifying cyclone. The same effect is obtained in the heavy-medium cyclone where centrifugal force in heavy liquid suspensions is applied to the specific gravity separation of fine coal.

Capacity of the cyclone is based on the diameter of the large end, which may vary from 8 in for the 3.5-tph unit to 30 in for the 60-tph cyclone. Size of the feed includes the range from 48M to $\frac{3}{4}$ in, although some recent installations handle coal as coarse as $1\frac{1}{4}$ in. Magnetite is used to make up the heavy medium, increasing the gravitational forces within the cyclone 20 times or more and separating acceleration compared to a quiet bath is of similar magnitude.

The feed is first deslimed on sieve-bends used in conjunction with vibrators.

Slimes in the minus 48-mesh range are directed away from the system, and the deslimed raw coal is introduced into a head tank with the medium. A constant head of 15 ft is maintained on the feed stream to the cyclone.

The heavy-medium cyclone system obtains effective separation anywhere on the specific gravity scale. With electronic control the system can maintain the required specific gravity continuously.

Other corollary benefits may be obtained. The effects of viscosity are minimized, and a clean cut separation can be made using dirtier water than in simple water washing systems. There is no variation in efficiency in starting up or stopping, and maximum efficiency is obtained through all ranges of capacity. There is no measurable degradation of the coal and no lag in the system to produce segregation. Less floor space is required because of unlimited possibilities for arrangement of the units.

The cyclone cannot function without auxiliary equipment. The complete system must include preparation of the feed, preparation of the products, maintenance of uniform density of the fluid medium and recovery of magnetite. The cyclone may be set in any position, even upside down, but the most desirable layout can usually be had by laying it on its side. This makes it easier to direct the products to the drain-and-rinse screen.



Auxiliary Ventilation,
by Thomas L.
Garwood, assistant
vice president,
Orient Div.,
Freeman Coal
Mining Corp.,
West Frankfort,
Ill.

Air is invisible, and the handling of air in the mine is somewhat of a mystery to many men who daily depend on it for their personal safety. When its use in ventilation is not clearly understood it can be misapplied, and this introduces hazards. There is no equipment in use now or which has been used in the mines that has not at some time or other been misused, and when contributing factors occurred coincidentally, has not been charged with causing disaster. The use of auxiliary blowers is not new. It is a revival of an excellent piece of equipment to be used as a mining accessory.

The Freeman organization has designed some blower fans for direct mounting on continuous miners. The fans are operated continuously from the hydraulic circuits of the machine which provide the power to drive a hydraulic fan motor.

In applying blowers the full volume in the split need not play on each face. A portion of the total may be directed into the area of actual mining, sufficient to dilute the gases, and the remainder may be released farther back from the face to dilute rib gas. The raising of objectionable quantities of dust can be avoided by doing this.

An alternate method is to dump the entire quantity of air near the rear of the machine and to use a separate blower, usually mounted on the machine, to pick up a portion of the air and project it to the face with considerable velocity.

Exhaust fans can be very inefficient. Their major claim is dust removal, but this may lead to concentrations of dust at other points.

The major point is that auxiliary fans should be intelligently employed and properly maintained. If these steps are observed, they can be decidedly advantageous, especially in continuous mining.



Phases of AC Application in Underground Power Distribution, by A. C. Ruedy, electrical engineer, Ensign Electric & Mfg. Co., Huntington, W. Va.

The portable underground transformer is the heart of a system for supplying reliable, safe, economical power in mines using AC-powered equipment. There are three parts to the transformer system, the high-voltage control equipment, the transformer itself, and the low-voltage connections and controls.

The matter of selection is extremely important. For example, if dry-type transformers are chosen it should be recognized that better lightning protection may be needed. On the other hand, liquid-filled transformers may get preference, but the liquids require a certain amount of handling.

The purchaser at present has a wide range of insulating materials to choose from. The silicones are especially valuable because of their superior resistance to heat, wear, contamination and corona. In fact, silicone insulation surpasses specifications, in actual performance.

On the low-voltage side of newer units provision can be made for ground-fault tripping of each secondary circuit. False tripping by stray currents can be ruled out by proper instrumentation. Ground wire continuity is important, and this condition can be monitored by new devices offered by manufacturers.

Special covers can be supplied for transformers that must operate in wet, dusty atmospheres, and special skid mountings make it relatively easy to keep the source of power for face machines close to the face.



Economic Aspects of Direct Reduction of Iron Ore in Illinois, by Dr. Walter H. Voskuil, principal mineral economist, Illinois State Geological Survey, Urbana, Ill.

The steel industry has long been interested in a simple workable process for direct reduction of iron ore. The process is under investigation by every major steel producer in the United States. There are possibly 15 or more methods which have been devised on a laboratory or pilot plant scale. One or two of these have reached commercial production abroad.

Interest in direct reduction arises because of costs and raw material supply. The cost of scrap, an important ingredient of the steel furnace, has been going up and may continue to do so. Direct reduction may be able to produce synthetic scrap to supplement present supplies of blast furnace hot metal and natural scrap.

A second reason for interest in direct reduction processes is the mounting costs of blast furnace construction. It is possible that the capacity of existing blast furnaces could be expanded by enriching the charge with low quality iron from a direct reduction process.

A third reason is the limited distribution and increasing cost of coking coal suitable for the preparation of metallurgical coke.

The processes under study permit more flexibility in reductants; in some cases hydrogen, methane, or other gases are used. In other cases, solid fuels lacking the rigid specifications for coking purposes are suitable. Some processes also provide more flexibility in the ore that can be treated.

It is entirely possible that one or more of the many methods now being studied will find application in the steel industry. It is not expected to replace the blast furnace, but it may very well supplement or complement present methods of making steel.

Conditions appear to be unusually favorable for the introduction of one or more of the several processes of direct reduction into Illinois. Ores are accessible by water transportation from both the Lake Superior district or from Latin American sources. Iron ores of about 50 percent natural iron content may also be available from adjacent Missouri. Coal is

mined efficiently in the mechanized and highly productive mines of Illinois and can be delivered to Waterway side with small additional transportation cost. A potentially large market exists in the St. Louis industrial area in the steel industry itself or in iron and steel foundries. Climatic conditions are favorable for all year operation of waterways handling southern ores. Efficient ore handling facilities at tidewater on the Gulf make for economical movements of imported ores.



Deep Stripping in the Future in Illinois, by G. H. Utterback, secretary-treasurer, United Electric Coal Cos., Chicago, Ill.

Over 47% of the coal produced in Illinois in 1958 was strip-mined, and this situation is expected to continue. However, success in the future will depend upon moving dirt farther, faster and cheaper. The stripping industry now is being squeezed by lower output per man in the open pits against higher output per man in the deep mines. Based upon a pure projection these curves of deep and strip productivity should cross in 1965. However, the development of new machines for the stripping industry should slow the decline in strip-mining productivity and postpone the date when the productivity curves will cross.

Improved drills for efficient production of vertical blastholes have been instrumental in permitting recovery under deep cover where hard strata occur in the highwall. The development of blasting techniques using fertilizer-grade ammonium-nitrate explosives has been a lifesaver. Drilling technology may be further advanced through the development of high-frequency percussive methods.

The big shovels and tandem stripping with shovel and dragline have made it possible for a number of companies to handle thicker cover, thus increasing reserves. Neither of these approaches was practical, however, for United Electric, so the company, led by Frank Kolbe, president, devoted energy, money and effort to the successful development of the Kolbe wheel excavator.

The latest of the Kolbe wheels presents a number of components which were totally designed by United Electric personnel, including heavy-duty idlers for the high-speed belts, a set of live rolls for transferring material from the digging wheel to the belt and the wheel buckets themselves, which are fitted with self-cleaning bottoms. (A full description of the latest Kolbe wheel appears in *Coal Age*, August, 1959, p 82.)

Tuition Supplements — One Good Way To Help Our Colleges And Universities

The business community has made an impressive start in going to the desperately needed financial aid of our colleges and universities. Business contributions to higher education have increased from only \$40 million in 1950 to \$136 million in 1958.

This rise in financial aid to higher education should be a great source of satisfaction to the business community. But it goes only part way toward meeting the growing needs of colleges and universities for financial help. Over the next ten years business aid to our privately supported colleges and universities alone must increase to at least \$500 million a year merely to provide decent faculty salaries and meet the increased operating costs of taking care of enrollments that will almost double.

One pervasive reason why many business firms have not joined the ranks of the companies contributing to higher education seems to be that, in the interest of prestige and public relations, they are making their provision of aid contingent upon finding some particularly novel way of providing it. So long as this point of view persists, business aid will lag, for there are simply not enough ways of providing financial aid that are both notably novel and sensible.*

How The Plan Works

There are, however, some well-tested ways of providing aid which improve rather than fade

in appeal with more using. One such way is the making of supplemental tuition payments to colleges and universities at which a company's employees take courses.

Many companies have scholarship or tuition-refund programs which cover all or part of the costs to their *employees* of taking college courses. But, in most colleges and universities, tuition charges fall far short of covering the full cost of the education given. By making an unrestricted "cost-of-education" grant a part of their employee scholarship or tuition-refund plans, these companies could make a material contribution toward covering the *college's* full costs as well.

The tuition supplement can be a fixed amount or a percentage of the tuition charged. Some plans provide for supplements as high as 100% of tuition, though there is usually an upper limit to the total supplemental payment given for each employee enrolled in the institution.

The plan seems to have originated with the Ford Motor Company Fund. When we at McGraw-Hill first learned of it, it appealed to us as having so many advantages, and so few disadvantages, that we adopted it as one part of our own program of financial aid.

*The efforts of the McGraw-Hill Publishing Company to find a suitable method of aiding higher education prompted the writing of a "more or less Socratic dialog" entitled *A Business Wrestling with the Problem of Aid to Colleges and Universities*. Copies of this pamphlet, which underlines the difficulty of finding both a novel and satisfactory method of providing aid, are available on request.

**HOW THE HEADS OF SOME OF THE INSTITUTIONS
TO WHICH MCGRAW-HILL HAS MADE GRANTS FEEL
ABOUT THE TUITION SUPPLEMENT PLAN**

"We are pleased not only because this addition to the never adequate supply of non-earmarked funds is a most welcome one, but also because it attests to the fact that the employees of our neighboring business firms are benefiting from the courses we offer at times convenient for them. We hope this mutually beneficial plan may continue and grow with the years."

*Grayson Kirk, President
Columbia University*

"I shall take this occasion to express deep sentiments of appreciation, in my own name and in the name of the members of the Board of Trustees, for the very effective manner in which your corporation is aiding higher education by the payments made under your tuition supplement plan. Certainly your action is indicative of the fact that you realize industry and higher education must join forces to preserve the basic American system of free enterprise."

*Very Reverend John A. Flynn, C.M.
President, St. John's University*

"The growing recognition by business and industry of the financial needs and important services rendered to the community by the colleges and universities is most encouraging, and Temple University is deeply appreciative of the fine support extended through McGraw-Hill's program of supplementary grants."

*Robert L. Johnson, President
Temple University*

The Plan's Advantages

The main advantages of the tuition supplement plan are:

- **It is simple and easily administered.** Payments can be made when scholarships or tuition refunds are granted, or at another time convenient to the company.
- **It relieves the company of the difficult and sometimes disagreeable task of choosing one college rather than another.** The individual employee makes the choice.
- **It directly serves the interest of the company by encouraging and aiding the**

institutions where its employees take courses. In a sense, the company makes contributions in direct proportion to the value it receives in education for its employees.

- **It directly serves the interest of the colleges and universities receiving the grants by getting money to them in the form most appreciated—unrestricted funds to be used at the discretion of their administrators.**

Largely because tuition supplements are unrestricted as to use, this plan enjoys the unqualified approval and gratitude of the schools receiving such aid. This is not true of some of the other plans for granting aid to colleges and universities.

Tuition supplements, of course, can't be regarded as large efforts relative to the need of higher education and the responsibilities of business. But they are a very practical and useful first step, involving almost no problems. If you are not familiar with the idea of supplemental grants, why not discuss it with some of your friends in the field of higher education?

The Price Of Novelty

Our experience with tuition supplements indicates that this is an excellent plan, and we are glad to recommend it to other companies looking for an effective method of providing financial aid to higher education.

At any rate, we hope that business firms will not postpone granting financial aid until they find some novel way of doing it. If they do, it will be another case of too little and too late.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

MCGRAW-HILL PUBLISHING COMPANY, INC.

Foremen's Forum

Seven men offer their assessments of . . .

The Future of Man

Here are the observations of seven concerned men on the present state of world affairs and some of the problems that will have to be solved to insure Man's emergence into a brighter, more rewarding future.

MOST OF US are so necessarily engrossed in the touchy process of making a living that we seldom vault thoughtfully into the larger purposes, directions or destinations of Man in his World. The recent dedication of the New York headquarters of Joseph E. Seagram & Sons was the occasion for a symposium—Dr. Milton S. Eisenhower, chairman—in which these scholars gave their thoughts on such matters.

At the risk of being "out of character" on these two pages, we offer excerpts from the Sept. 29 proceedings at the Waldorf-Astoria. You may disagree with viewpoints, but we all must agree that these are important matters. We and our children will be wrestling with the issues from now on.



Dr. Milton S. Eisenhower, president, The Johns Hopkins University.

"Within the lifetime of most of you, we have changed from happy self-containment to exacting global interdependence; from carefree isolationism to burdensome world leadership; from the simple life of a debtor nation to the complex, frustrating responsibilities of a creditor.

"One of the most dramatic events in our lives is the disappearance of physical, earth-bound frontiers. Frontiers now are intellectual, and in outer space.

"The lag between discovery and application has shortened impressively: Thus, 75% of the drugs given to hospital patients last year were wholly unknown

ten years ago. Fifty per cent of the products manufactured by one of our largest chemical companies did not exist 15 yr ago.

"To accomplish the essential task of living together in relative harmony in this period of unrelenting interdependence—and, knowing the awful consequence of failure—we must now adhere to a total program that will yield peace with justice, and the constructive use of our new-found power.

"Through better education in all nations, we must improve cultural levels and achieve that genuine human understanding on which all cooperative action must be based.

"Economically, we must establish stable, mutually-helpful trade relationships and voluntarily combine our efforts to help the less privileged nations, largely through their own efforts, to bring about a rise in the standards of living of their peoples.

"Politically, we must settle every dispute, large or small, at the conference table, free of threat of coercion."



Lord Bertrand C. Russell, philosopher, mathematician, educator and author.

"Even if another war does not wipe out all of civilization, it would set back man to primitive barbarism from which it would take several thousand years to return to the present degree of wisdom.

"Three alternatives exist. Science during the next hundred years is likely to cause either utter disaster or great in-

crease in human welfare. Which of these will be realized depends upon the volitions of human beings. Science has given man the means of doing more good to ourselves and also more harm to others than has hitherto been possible. What causes perplexity is that no means have been discovered of doing good to ourselves while at the same time doing injury to those whom we dislike. If any of us are to be happy in the coming century it can no longer be at the expense of others.

"While nuclear weapons are most discussed and feared currently, chemical and biological weapons are likely soon to prove equally deadly and more dangerous because they are less expensive. The fate of the world depends on the selection of statesmen who further a World Authority which will allow man to enjoy the universal well-being which science has made attainable."



Deveroux C. Josephs, chairman, President's Committee on Education Beyond the High School.

"Three 'conflicts' man must face as a result of the traditional lag of habits and behaviors behind science are the conflicts between work and leisure, between custom and change and between our traditional fear of government and the need to plan our future.

"For the first time in recorded history an entire nation lives beyond the edge of hunger and privation. This is achieved in a work week that has shrunk in a half century from 52 to 40 hours. These 12 hours are not required for the necessities. They are active waking discretionary hours. Leisure, recreation, vacuity or mischief can fill them. We will have to learn how to fill the time we have literally manufactured in our factories.

"On the conflict between custom and

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- | | |
|-----------------------------------|-------------------------|
| (A) Settling Rates | (D) Thickener Unit Area |
| (B) Final Density | (E) Overflow Clarity |
| (C) Effect of Flocculating Agents | |

TESTS AT NO CHARGE—These tests can assist you by eliminating risk of specifying a thickener that's too small to do the job or too large and costly for your needs. Ship 5 gallon slurry sample prepaid to Denver Testing Division, 1755 Blake St., Denver, Colo.

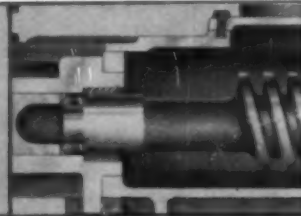
Compare these distinctive features of DENVER Spiral Rake Thickeners:



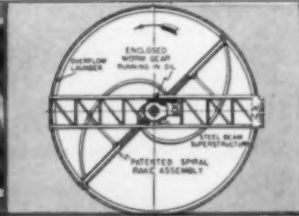
NEW ENCLOSED HOUSING protecting gear and drive mechanism is simple and rugged—available in sizes through 72" for light, medium, heavy and extra heavy duty. Tanks, steel or wood, in sizes to 150'. Write for Bulletin TS-86.



HIGH STRENGTH GEAR rides on replaceable no friction—no wear formica pads placed at periphery of the gear. Maximum stability, low bearing pressure and oil bath assure long life.



WORM AND WORM SHAFT are made from alloy steel, machined, case-hardened and ground. Shafts are proportioned to minimize deflection and retain full face gear-worm meshing.



SPIRAL RAKES move settled solids to center discharge port in only one revolution. Minimizes chance of choke-up, assures continuous operation. Why take 8 or 10 revolutions to bring pulp to the discharge cone when one revolution by the spiral rakes will do?

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Phone 41857



Foremen's Forum (Continued)

change, our very future depends on our adaptability to change because it will come at even faster pace. The learning process must continue through our lives not only as an enrichment of our minds but as a matter of national survival lest we be destroyed by our own ingenuity. Few workers can expect to spend a lifetime practicing the same skills and applying the same body of knowledge with which they started their careers.

"Regarding the third conflict, the world now must expect more planning to originate from government—by trained and wise public servants. We can no longer risk the slow groping of evolutionary adjustments. The story of civilization is approaching a climax in which the surviving characters will be those who can step from the pages of the book and influence the writing of the next chapter."



Dr. Ashley Montagu,
anthropologist,
author and
educator.

"Man has become adept at learning not only more sound things than any other creature on the face of this earth, but by the same means, more unsound things than any other creature. The result is not intelligence, but confusion. Education is the key to this problem, a specialized education conceived as the science and art of human relations plus the critical ability to use one's mind critically.

"This would require a re-evaluation of our present modes of instruction which fail to meet the definition of education as 'human discipline of the whole person.'"

"The future of man cannot be taken for granted. If we are to ensure the future the present is the time to work for it however discouraging the prospects may seem.

"The preservation of man is the first, most important, and most immediate end toward which we must work.

"War must be outlawed. However gradually this end may be achieved, it is the necessary and sufficient condition of our continuing to be. Political or any other kind of differences must be settled, not by force but by humane discussion and mediation.

"Man is the most extraordinary of all nature's production, a most improbable creature, brash and bright, a spoiled brat, full of promise only a small part of which has been realized.

"He is potentially capable of anything but virtually every great advance that man has made toward whatever humanity he has achieved has been at the cost of toil, and sweat, and persistence in the face of all discouragement.

"If we labor in the right direction, I believe we may be confident of a happy outcome for man."



Dr. Hermann J. Muller,
Professor of
Zoology, University of Indiana, and
Nobel prizewinner
in physiology and
medicine, 1946.

"Man's greatest space age responsibility is production of the best children possible. Men must come to realize before it is too late that the germinal material of mankind is the most precious trust. To be cosmic conquerors, men must overcome the fanaticisms and superstitions that induce them to threaten to annihilate each other.

"Only by mastering and continually remolding ourselves can men prove worthy of our exalted role of cosmic conquerors, and thereby achieve the increasing fitness that the mightier challenges of the future will demand of us. Despite the emphasis on space age achievement, there is great need for study of man's inner world, which is more wondrously organized than any star or galaxy.

"Man can achieve greater capabilities and a richer life by learning how better to govern his cells and their workings."



Sir Julian S. Huxley,
biologist, author
and first director-
general of
UNESCO.

"Man must take immediate steps to work out a world population policy—aimed at optimum instead of maximum

numbers—to prevent erosion of the world's resources. Such a program will help develop a 'Fulfilment Society' to replace the Welfare State.

"Man is now realizing he is the latest dominant type in evolution, and is responsible for the progress and fulfilment of the evolutionary process on this planet. In the coming century man's first job will be to think collectively, in terms of continuing the human species as a whole.

"He will soon be driven to plan a co-operative project of world development, in which all peoples can participate, aimed at securing greater fulfilment for more human beings. To accomplish this end he will need a vast program of research on human possibilities and methods for realizing them more fully.

"Already the progress of biochemistry and psychology is revealing new possibilities of physical and mental health, and educational research will undoubtedly show the way towards adequate utilization of the variety of inborn human capacities.

"As a result, the idea of the Welfare State will be superseded by the Fulfilment Society. The faith of the future will be in the possibilities of the human species, and the power of human knowledge to realize them more effectively."



Robert L. Frost,
four-time winner
of the Pulitzer
Prize for poetry.

"Science may enable mankind to control its own evolution, but men and women will cling to 'passionate preference,' pairing for love and money.

"Laboratories are ready to go ahead 'messing around' until they improve the human race to the point it is approved by a board or foundation. However, I foresee no society where artificial insemination won't be in bad taste.

"The distance from monkeys to humans was amusingly short, and it shouldn't be too much longer from us to supermen.

"It might be better if man stopped short here and now. If we are thought to have matured to a point where we can take control of our own evolution to go on with it, why can't it be to stop ourselves in our tracks, if there isn't too much the matter with us as we are? Science is not all-important."

Choose from Allis-Chalmers complete line of vibrating screens for:



Ripl-Flo Screen

Low-Head Screen

Aero-Vibe Screen

SIZING ROM COAL

DEWATERING
Coarse and Fine Coal, Middlings and Refuse

MEDIA RECOVERY

DRY SIZING
Raw, Crushed and Moist Fine Coal . . . Middlings

WET SIZING
Raw, Washed and Crushed Coal . . . Middlings

DEWATERING SLUDGE

SOLIDS RECOVERY

Whatever your need . . . Allis-Chalmers can provide the exact vibrating screen your coal process requires!

For applications in ROM screening, sizing, dewatering, and media recovery, Allis-Chalmers has a complete line of standard units up to 8 by 20 feet . . . screens which have been use-tested and proved at coal preparation plants in all areas of the world. The quality of A-C screens, the satisfaction

of users account for the fact that *more A-C screens are used by the coal industry than screens of any other manufacturer.*

A helpful screen selection guide has been prepared to help you choose the right model for your process. Contact your Allis-Chalmers representative or write for Bulletin 25B6280. Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

Aero-Vibe, Low-Head and Ripl-Flo are Allis-Chalmers trademarks.

ALLIS-CHALMERS



A-1201

Operating Ideas



HORIZONTAL-THRUST LOADER skims off top layer of coal without disturbing fire clay parting. Unit casts clay aside before loading lower bench of coal.

Special Shovel Solves Tough Loading Problem

A 2% REDUCTION in ash content plus simplified selective loading of a split seam of coal are two outstanding benefits resulting from application of a horizontal-thrust coal loader at the Kirkville Coal Co., Centerville, Iowa.

Kirkville mines a 36-in seam which has a 2-in clay parting cutting through it 22 to 24 in from the top. When the

company used a conventional coal shovel, it was virtually impossible to keep the clay out of the coal because the arc of the dipper was such that the clay was heeled into the coal as the dipper filled. C. E. "Swede" Hanson, owner of the coal firm, solved the problem by using a Koehring 205 Skooper to do the loading.

How the Loader Works

The Skooper's level crowd action makes it possible for the operator to skim off the top bench of coal without mixing the clay in with it. Similarly the Skooper's action enables spoiling off the fire clay from the lower coal, which then can be loaded cleanly.

Prior to using the new loader, a ½-yd shovel with a 1-yd coal dipper was used. Since the cycle time of the new unit compares very favorably with that of the shovel, the actual coal production of the Skooper is about double that of the 1-yd shovel. In other words, the company has doubled loading capacity while loading a cleaner product.

According to Mr. Hanson, using the Skooper has resulted in a product with at least 2% less ash. In using an ordinary shovel, the ash content ran as high as 7 or 8%. With lower ash content and higher Btu's, the coal is more saleable.

The coal mined at Kirkville is Iowa's top seam and the company has 1,000,000 tons of reserves in some 3,000 acres. The overburden, consisting of dirt, shale, clay and some ledge rock, averages about 24 ft in thickness. This material is removed with a dragline and two stripping shovels.

A fleet of five 8-ton Chevrolet trucks serve the horizontal-thrust loader. Each of these units makes seven or eight 12-mi trips daily to the preparation plant in Centerville.



HANDY RACK for self rescuers and extinguishers can be set in a few seconds.

Portable Rack Holds Self Rescuers Fire Extinguishers

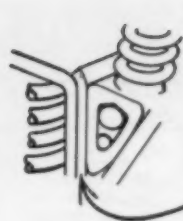
WHERE do you store your self rescuers and fire extinguishers on the section? How many inspectors or mine foremen can say that these two items will be in a certain place?

Self rescuers and fire extinguishers are emergency items and when you need them you need them instantly. The management at Eastern Gas & Fuel Associates' Grant Town operation devised a positive method of storing these two items. They made upright stands with two racks for self rescuers and two hooks for fire extinguishers. In the accompanying photo, which appeared in a recent issue of *The Safe Mine Foreman*, Paul Jones, assistant master mechanic, demonstrates the stand using a fire extinguisher and a small first aid box in lieu of a self-rescuer container.

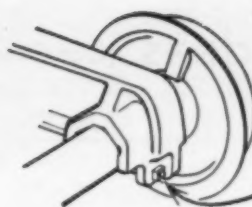
The Safe Mine Foreman suggests that this stand be erected in the center of the breakthrough used as a foreman's office and meeting place. Thus everyone will know where to find these emergency items. They will be in plain sight and will not likely be blocked by material and supplies.

Next time the section is moved the stand can be taken down in 10 sec. It can be reset in a new location in less time than it takes a workman to find nails and a hammer.

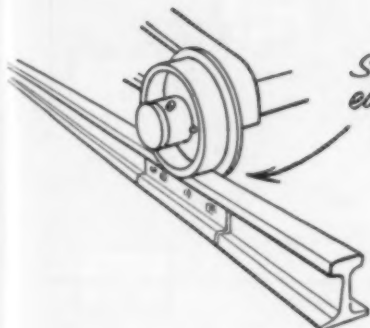
The stands are made of pipe with a nut welded at the top and a point at the bottom. A thread bar with handles fits into the top of the pipe. By this means the stand can be extended or retracted to fit the height of the location in the section.



Movement between bolster and side frame is taken on specially designed wear surfaces



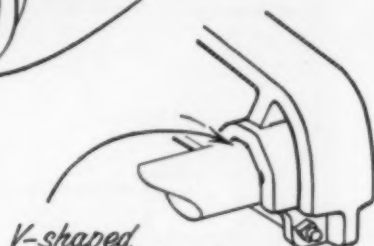
Quick wheel change



Smoother ride even on rough tracks



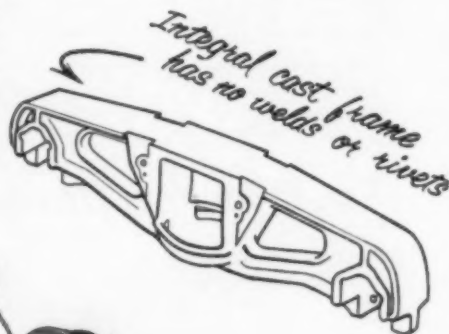
Large center bearing for longer life



V-shaped machined axle grips for controlled flexibility and truck alignment



Check these "plus" features



Integral cast frame has no welds or rivets

OF NATIONAL NC-1 TRUCKS

If you're considering the purchase of new 8-wheel mine cars . . . or if you're thinking of modernizing older cars—now is the time to check the advantages of National NC-1 Trucks. National NC-1 Trucks have controlled flexibility for track variations yet still maintain truck alignment through their machined V-shaped axle grips. In addition, NC-1 Trucks have a built-in shock absorbing mechanism.

You get more out of your mine car investment per workshift

. . . per day . . . per year. And at the same time you minimize spillage . . . get greater protection for your equipment, track and structures . . . slash maintenance to a new low.

Yes, now is the time to check National NC-1 Trucks—they make sense for 8-wheel mine cars

. . . make dollars for operators, too.

WILLISON AUTOMATIC COUPLERS

RUBBER CUSHIONED UNITS

NC-1 CAR TRUCKS • NACO STEEL WHEELS

NACO STEEL LINKS & SWIVEL HITCHINGS

AA-8077

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Established 1868

Cleveland 6, Ohio

Operating Ideas (Continued)

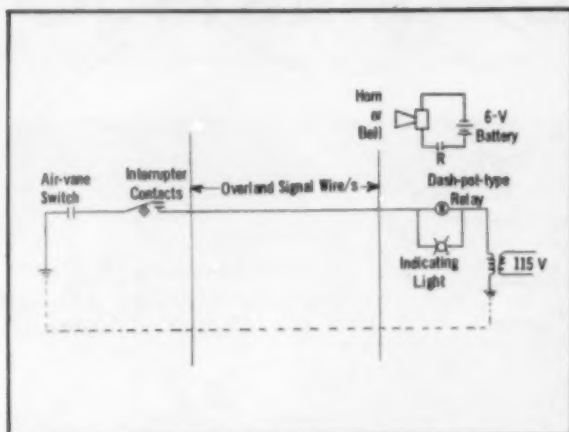


Fig. 1—Common system for fan indication includes gear reducer on fan shaft to drive contacts, air-vane switch, coil of dash-pot-type relay and indicating light.

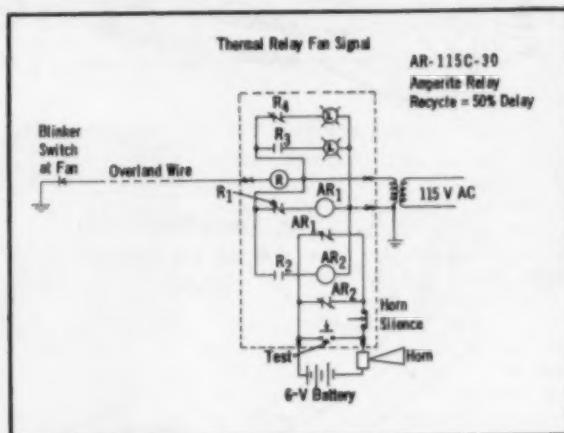


Fig. 2—Improved system has two thermal relays, standard plug-in relay and indicating lights. The whole unit costs less than the old-type relay.

Fan-Indicating Devices for Mine Service

By W. C. Kegel

General Master Mechanic, Vesta-Shannopin Coal Div., Jones & Laughlin Steel Corp., California, Pa.

VENTILATION FAILURE is the greatest fear of many mine operators. The precautions to be taken because of fan failure must be put in action quickly and in the proper order. This fear of failure is reason enough that a well-designed, easily maintained system for controlling mine power and ventilation is of prime importance.

Fan-indicating devices are required by law. Both a visible signal blinking at a rate indicative of the fan speed and an audible signal in case of fan failure are required. The most common system of this type is shown in Fig. 1. A signal wire is installed from the remote fan to the manned station. Attached to the fan shaft is a small gear reducer which drives a set of contacts. The ratio of the reducer could be 10 to 1, and if the fan were turning at 600 rpm the contacts would close 60 times per minute. These contacts are in series with an air-vane switch. Connected to this air-vane switch via the signal wire is the coil of a dash-pot-type relay. Across the coil is connected the station indicating light and in series with the relay contacts is a battery-powered horn.

When the fan is started, the air-vane switch closes and 60 times a minute the circuit is completed through the relay and

indicating light at the manned station. The relay plunger, or armature, is so damped that before it can complete its available drop the relay is re-energized and raises the armature again and thus does not close the horn circuit.

The blinking light indicates the fan speed and the air-vane switch guarantees failure indication if the fan should stop with the interrupter contacts closed.

A few years ago the Vesta-Shannopin Div. started using what management believes to be an improvement on the dash-pot relay and paralleled lamp. A circuit made up of two Amperite thermal relays and a standard plug-in relay replaced the older dash-pot type. This circuit is shown in Fig. 2.

Components, along with two indicating light bulbs, are enclosed in a small box. The unit costs less than the old-type relay, can be replaced by simply plugging in a new unit.

These sealed, plug-in relays lend themselves readily to many low-current circuits associated with mining work. Maintenance is practically nonexistent, since failure is corrected by replacement of a complete relay, which can be done by the least experienced man. The relays are well designed and constructed and because of mass production are economical.

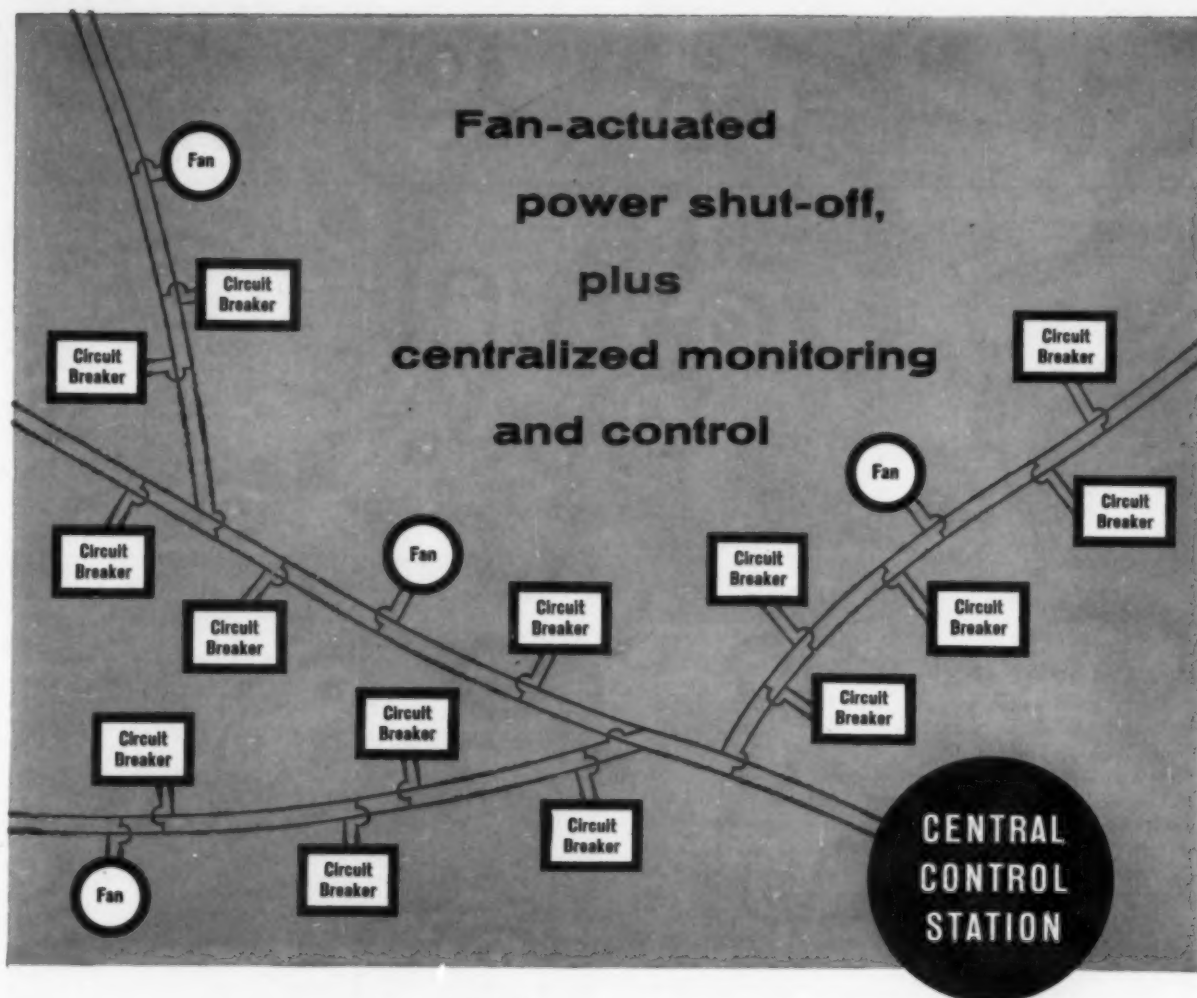
The Amperite thermal relays can serve as timing devices, and when used in combination with the others, many circuits can be designed that reduce maintenance to a minimum. The sealed relay is not affected by dust or moisture.



Old Bus Is Portable Shop

AN OLD SCHOOL BUS, purchased at salvage value, serves as a portable shop and supply center for the Big Valley Coal Co., Slippery Rock, Pa. To convert the bus to a shop, Big Valley removed all of the seats and built a work bench along each side.

The bus, carrying small tools, lubricants and small parts, is driven to a convenient location in the pit and parked where materials are handy for small maintenance jobs. In addition to providing a sheltered work area in rain, snow or cold, it serves as an office for supervisors. A telephone installed in the bus enables supervisors to talk with the main office or order emergency repair parts.



...over a single pair of wires

Here's what this new FEMCO system provides:

1. **Automatic shut-off** of power going into the mine, in the event of fan failure.
2. **Centralized monitoring** of all fans and circuit breakers.
3. **Selective remote control** of circuit breakers.

Any number of fans and circuit breakers, in any combination, can be handled over a single pair of wires in the mine or on the surface.

Fan monitoring is continuous. Two indications for each fan are provided, one showing that fan pressure is normal, the other showing fan speed. Loss of pressure at any fan automatically shuts off all power to the mine after a predetermined interval from 0 to 30 minutes. It

also sounds an alarm, at the office, which continues until silenced. Monitoring of circuit breakers is on a programmed basis.

The time-saving advantages of this system are obvious. Fan monitoring permits instant identification of the fan which is malfunctioning, and centralized control of circuit breakers makes it possible to restore power at all locations in less time than it would take a man to reach any one of them.

Femco Monitoring and Control Systems are now in operation in a number of leading coal mines, and more installations are being made each month. For full information, write to FEMCO, INC., IRWIN, PA. We will be glad to discuss your specific requirements.

VMA 8427

Femco

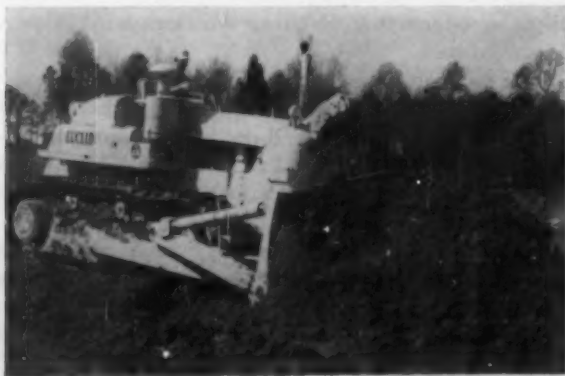
COMMUNICATIONS: Carrier and wired audio systems for all mining and industrial applications. **MONITORING:** Fans, circuit breakers, valves, pumps, compressors, etc. **TELEMETERING:** Flows, pressures and other functions. **REMOTE CONTROL:** Pumps, valves, circuit breakers, opening pit covers, furnace doors, cranes, or other moving equipment.

Equipment Developments



Reversal Protection

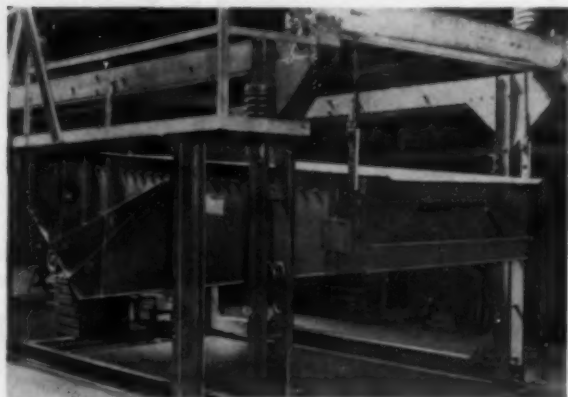
Stephens-Adamson Mfg Co., Aurora, Ill., has developed 2 types of holdbacks to protect personnel and equipment from reversal of conveyors and elevators. A standard roller-type holdback is designed to give positive protection to bucket elevators and inclined conveyors. With the installation of a holdback on the head shaft, a conveyor or elevator can be stopped at any time without the danger of the load traveling backwards. The standard unit operates on the roller wedge principle so that when power is interrupted or when the loaded belt makes the slightest move backwards the rollers wedge between the drum and wedge-plate preventing reversal quickly and without much shock, says the firm. The totally-enclosed-type holdback features a cast steel housing, hardened wedge block and hardened steel rollers. This type unit, notes the firm, has been very successful in protection of inclined conveyors and bucket elevators against accidental reversal. Totally enclosed design prevents entry of dust and foreign matter resulting in increased efficiency and less maintenance.



New Tractor

From Euclid Div. of General Motors Corp., Cleveland 17, comes the new Model C-6 tractor climaxing 5 yr of exhaustive testing, according to the firm. The tractor, declares Euclid, is completely new in design concept and has 211 net hp and a "Torqmatic" Drive consisting of torque converter and semi-automatic transmission that eliminates the master clutch.

Changes from one of the 3 forward speed ranges to another and from forward to reverse and back again are made under full power. Smooth positive track control is provided by a new system of common braking and steering that requires no adjustment of steering clutches or brakes, it is noted. Rear-mounted cooling system results in cleaner operation and permits close mounting of front end attachments. Operator visibility is said to be exceptionally good because the nose guard does not have to accommodate the fan and radiator. Standard track shoes are 22 in wide, track gage is 78 in and total ground contact area is 5,069 sq in. Overall dimensions are: 178 in in length; 100 in in width; and 96 1/4 in in height. Bare operating weight is 42,000 lb.

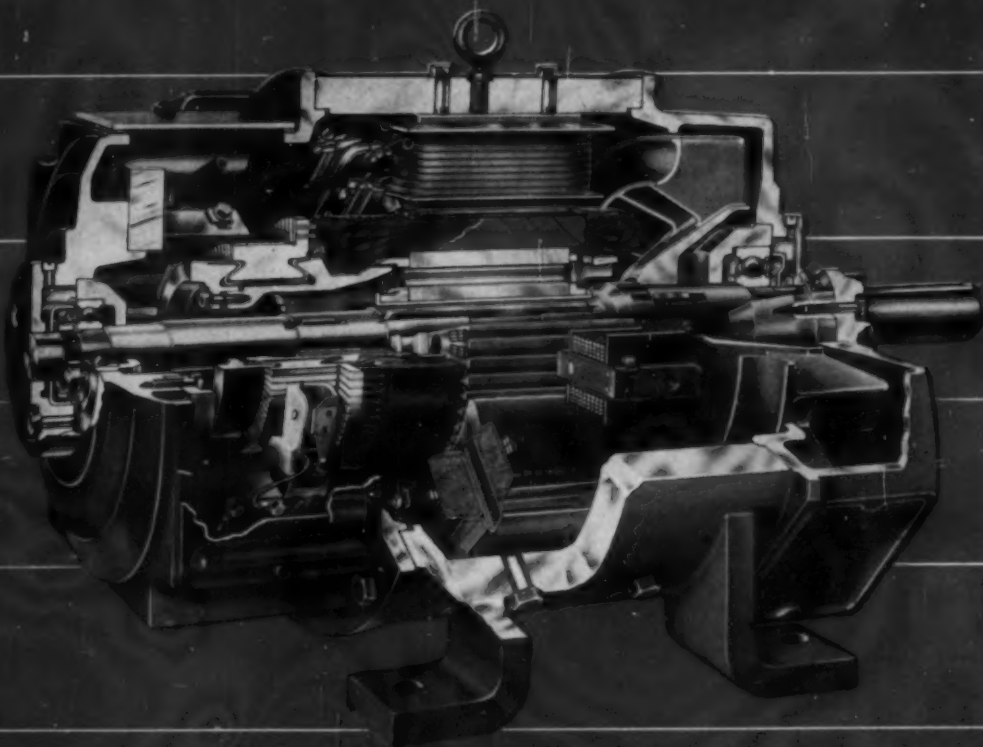


Versatile Picking

A new short-stroke horizontal "Low-Head" picking table for hand removal of refuse from scalped run-of-mine coal and other products has been announced by Allis-Chalmers Mfg. Co., Milwaukee 1. The new table, which can also be used as a conveyor or feeder, comes in 3, 4, 5 or 6 ft widths and in lengths up to 20 ft. The Low-Head mechanism imparts the motion to the table which can be arranged for floor mounting on air or steel springs or can be suspended from an overhead structure. It is available with a portion of its carrying pan perforated to remove degradation or to make a separation. The new table is equipped with a 1,200-rpm motor and requires about 30% less power to operate and less maintenance than conventional long-stroke, slow-speed, eccentric-driven picking tables, according to Allis-Chalmers. The company reports that one of the new tables a 6x16-ft unit, is in use at the Jewel Ridge Coal Corp. mine in Tilford, Ky. Coal is conveyed over the table at a uniform speed of about 60 fpm while slate, stone and other materials are removed before the coal goes to the crusher and washer.

Blasting Caps

Greater safety and economy are cited as advantages of multiple firing of explosive charges with "Coal King" delay electric blasting caps now available from American Cyanamid Co., New York 20. In multiple blasting, the Coal King cap detonates complete rounds of permissible explosives without requiring the shotfirer to return to the face between blasts, as is necessary for single-hole blasting. This technique of



THE RELIANCE SUPER 'T'

A New Kind of D-c. Motor With DYNAMIC RESPONSE

Here is a motor built to make maximum use of d-c. flexibility. The Super 'T' puts Dynamic Response into starts, stops, and speed changes. Dynamic Response gives you a 50% increase in torque and a 50% decrease in reaction time.

This top performance is due to advanced, balanced design. Lighter small diameter armatures cut mechanical inertia 50%. Superior Class B insulation, gives extended life even at temperatures as great as 130°C.

Top grade insulation plus engineered ventilation lets the Super 'T' take tremendous overloads. In fact, the Super 'T' can develop double normal horsepower during starts, stops, and speed changes.

The Super 'T' is a compact power package, designed inside and out for tough industrial service. From appearance to performance, the Reliance Super 'T' with Dynamic Response is today's most modern industrial motor.

C-1577



REEVES



RELIANCE ELECTRIC AND
ENGINEERING CO.

DEPT. 611A, CLEVELAND 17, OHIO
CANADIAN DIVISION: TORONTO, ONTARIO
Sales Offices and Distributors in Principal Cities

Equipment Developments (Continued)

rotational firing is said to result in reduced exposure of the shotfirer to dust, fumes and roof falls. The short-delay caps improve loadability over that previously obtainable in multiple blasting with instantaneous caps, notes the firm. Made with iron leg wires insulated with white plastic, Cyanamid's new cap comes in a choice of 15 different timing periods ranging in 25-millisecond increments from 35 to 375 milliseconds.



Improved Truck Line

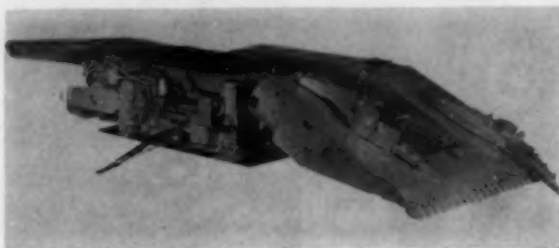
Increased fuel economy, a line of additional optional axles permitting bigger truck jobs, advancement in frame strength, wire systems, brake linings, oil pumps, generators, ignition distributors and fuel pumps all contribute to greater durability and reduced truck operating and maintenance costs, according to Wilbur Chase, truck marketing manager of the Ford Div. of Ford Motor Co., Dearborn, Mich. Ford's 1960 truck line, covering more than 480 models, ranges in gross vehicle weight from 4,600 to 51,000 lb with gross combination weights up to 76,000 lb and meets practically every trucking need from a small retail delivery operation to the on or off-the-road heavy-duty hauler, notes the firm. All 1960 Ford trucks offer modern short-stroke engines and a wide range of gear ratios and transmissions to provide proper road speeds at lower rpm for improved fuel economy and longer engine life, Ford declares. Inside the cab improved driver comfort and overall "cab livability" is featured.

FAN-DUTY MOTORS — Lima Electric Motor Co., Inc., Lima, Ohio, subsidiary of Consolidated Diesel Electric Corp., announces immediate availability of its Type EFD Fan Duty motor in rerated NEMA frame sizes 182 to 326U (1/4-15 hp). These motors come in speeds of 1,800, 1,200 or 900 rpm. The "air-over-motor" fan duty motors feature in addition to totally enclosed housings, deep external cooling fins which assure adequate cooling with a reduced transverse section to give lowest wind resistance, says the firm. All cooling surfaces are readily accessible for cleaning.

CAR SPOTTER—A new car spotter for positioning railroad cars at sidings has been announced by Hewitt-Robins, Inc., Stamford, Conn. The spotter is designed so that the wire-pulling rope is neatly reeled around a drum as pulling progresses. This eliminates the safety haz-

ards of conventional car spotters which permit the rope to coil up in a pile at the operator's feet, declares the manufacturer. The new machine can be operated without touching the rope and be equipped to operate by remote control from any convenient location. In addition to its safety features, the new machine is said to offer higher efficiency and lower maintenance cost. It has a Jones herringbone gear speed reducer which provides 40% more rope horsepower than worm-driven models, adds the firm.

WELDING — Page Engineering Co., Chicago 38, is offering the new "Kwik-Weld" unit designed to reduce maintenance costs, minimize down-time and afford greater production efficiency in repairing dragline chains. "V" slot design permits repairs for any dragline chain. The thin section of the link is easily



New Loader

For intermediate and higher seams, Goodman Mfg. Co., Chicago 9, has announced the addition of a new 38-in high coal loader. Typed as the 967, it has a rated capacity of 15 to 20 tpm and features a deep 30-in wide conveyor. Said to have good power and stability, the 967 comes with 2 1/4-in pitch conveyor chain, 4 1/2-ft ground contact of the 12 in wide treads and 4 motors, each 21 hp DC, 26 hp AC.

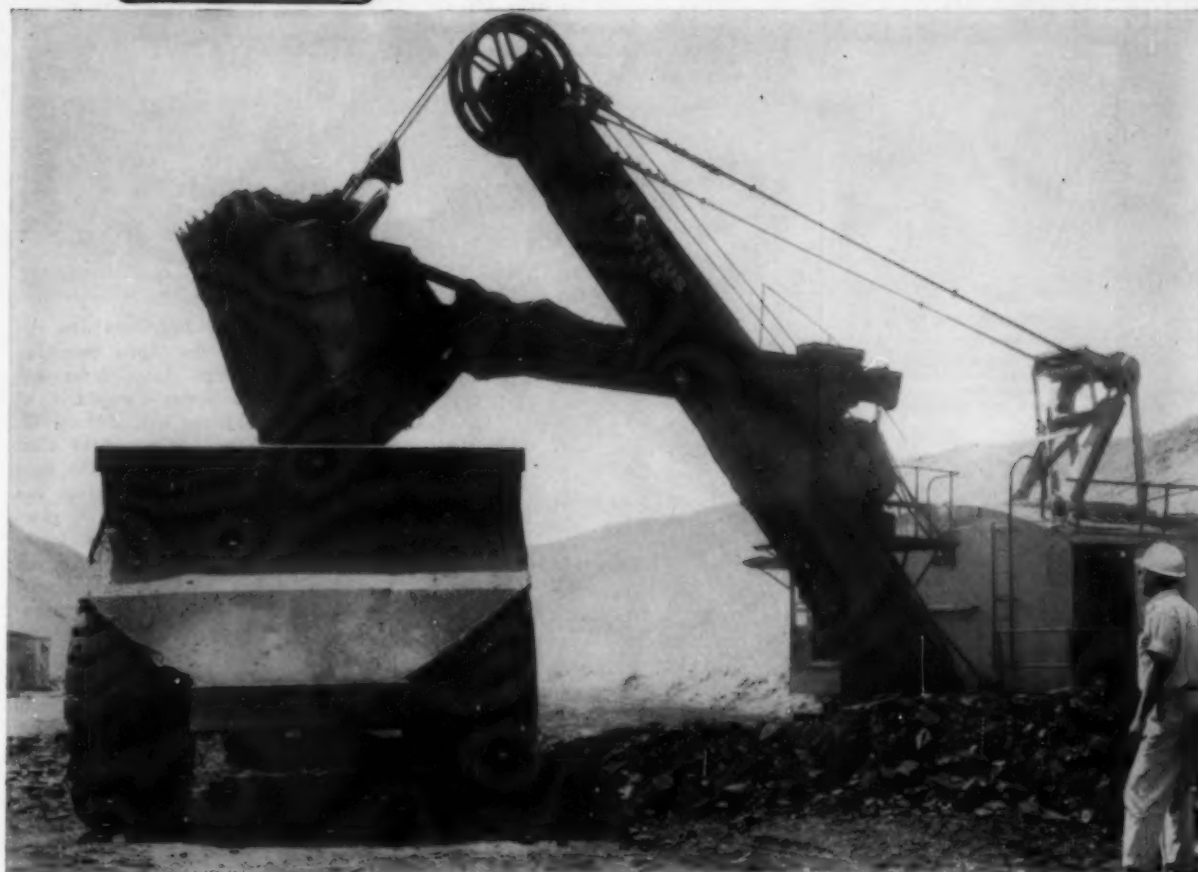
Powerful Tractor

According to International Harvester Co., Chicago 1, the most powerful crawler it has ever produced is coming off the assembly lines. New TD-25 comes with either a torque converter or gear-drive version. Both models get power from International's DT-817 turbocharged engine—a 6-cylinder, 4-cycle, direct-starting engine developing 230 net hp at the flywheel at 1,500 rpm. Four speeds forward and reverse are offered by the machine which has a drawbar pull up to 70,000 lb at .75 mph with adequate weight and traction. Operating weight is 26,000 lb. The gear-drive TD-25 has an operating weight of 35,500 lb and a 46,700-lb drawbar pull. It has 8 speeds forward and reverse. Among the many features of the new machine are: heavier reinforced track frames; large-reservoir track rollers with exclusive cartridge-type seals; a 3-pt track suspension to lengthen the life of track rollers, chains and pins and bushings; and the Planet-Power system which permits turning with controlled power on both tracks with effortless, finger-tip steering.



cut, removed and hooked into the chain. Putting the lug back into place and welding with a low hydrogen rod, pro-

B.F. Goodrich



Those B.F. Goodrich tires haul 40 tons of coal over roads made of abrasive limestone

THE Buckheart Mine #17 near Canton, Illinois, is one of many strip mines operated by United Electric Coal Company. Here trucks with 40-ton coal capacity make continuous 8-mile round trips between pit and tippie. Roads are made of abrasive crushed limestone. This could be a real tire-killing job, but the company avoids this costly problem by using B.F. Goodrich Rock Service tires. In fact, B.F. Goodrich tires have been used at Mine #17 since 1938!

B.F. Goodrich builds extra service into the Rock Service tire 3 ways: (1) The tread is extra thick and specially compounded to resist rock cuts and

snags. (2) Massive double-chevron cleats defy side-skids, give maximum traction in forward or reverse. (3) A FLEX-RITE NYLON cord body that withstands double the impact of ordinary cord materials. This B.F. Goodrich material resists heat blowouts and flex breaks and means more retreadable Rock Service tires and more retreads per tire.

Follow the lead of successful mine operators. Switch to new B.F. Goodrich Rock Service tires and start saving. See your B.F. Goodrich Smileage dealer, who is listed under Tires in the Yellow Pages of your phone book. *The B.F. Goodrich Co., Akron 18, Ohio.*

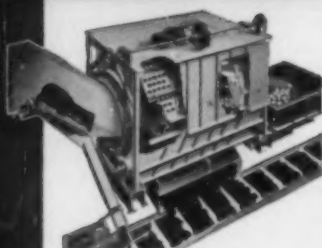
Specify B.F. Goodrich Tubeless or tube-type tires when ordering new equipment!



Smileage!

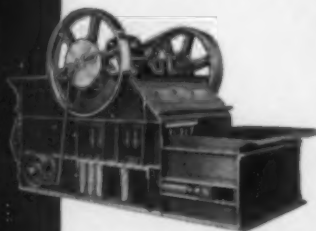
B.F. Goodrich *off-the-road tires*

America's most complete line of CRUSHING EQUIPMENT



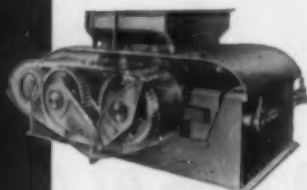
**McNally Pittsburgh
Rotary Breaker**

This unit allows positive control of top size in handling run-of-mine washery feed. Production of fines is held to a minimum.



**McNally Norton Vertical
Pick Breaker**

50% Less fines when reducing lump to egg and stove sizes.



**McNally Double Roll
Gearmatic ROM Breaker**

Built in tonnage ranges from 750 tph to 1400 tph. Full floating gearmatic drive.

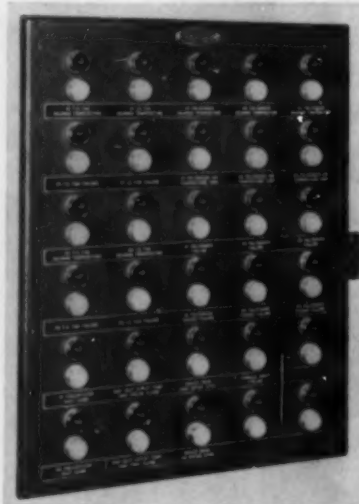


**McNally Gearmatic Stoker
Coal Crusher**

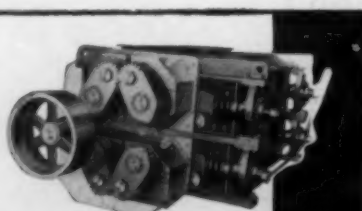
This unit offers three prime advantages: high volume production, plus accurate sizing, plus low percentage of fines.

Equipment News (Continued)

vides a permanent chain repair without rivets, bolts or pins. The smooth repair link is as strong if not stronger than the original unit, declares the firm. The repair unit affords the feature of flat inner contact surface for the hitch pin and a contour inner surface for maximum wear on the contour of the chain link.



NEW ANNUNCIATOR—The "Fail-Safe" annunciator, Series 50FS, from Panalarm Div. of Pannellit, Inc., Skokie, Ill., is said to have the unique advantage of enabling the operator to differentiate instantly between its own component failure and an "off-normal" field condition in the plant. New design utilizes 2 lamps power annunciator point, a red alarm lamp indicating field abnormality and white "trouble" lamp signalling annunciator component failure. The company notes that the 50FS can



McNally Two Stage Crusher
This unit consists of a double roll primary crusher mounted above a double roll secondary crusher—compactly arranged into a single rigid structure.

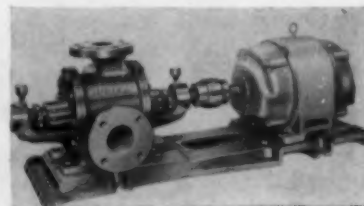
Available From Stock and on Short Delivery
For immediate action on complete information write, wire, or call

McNALLY PITTSBURG MFG. CORP.

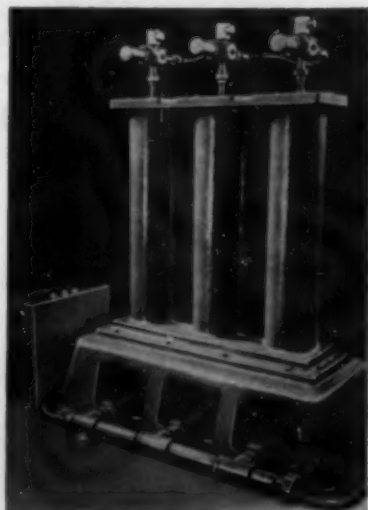
Pittsburg, Kansas

Wellston, Ohio

pay for itself many times over by saving valuable operator time by eliminating wasteful guesswork checking when no corrective action is required and by eliminating misunderstanding by the operator whose faulty action could destroy valuable process equipment.



TURBINE PUMPS—Important new design changes on the Apco two-stage turbine-type pumps have been announced by the Aurora Pump Div. of New York Air Brake Co., Aurora, Ill. Major new feature is a revised shell housing design which directs the fluid from the first to the second stage impeller in a 180 deg cross-over. By placing in opposition the resultant forces of first and second stages the forces are equalized and a condition of balanced radial loads is achieved. The arrangement also eliminates shaft deflection. Wear is reduced to a minimum by absence of metal to metal contact within pump channels and removable channel rings provide for easy and inexpensive replacement of eroded or corroded surfaces, adds the firm.



NEW-TYPE PUMP—The Crossley Machine Co., of Trenton, N. J., says it has developed a pump different in principle and design from any other pump in existence. The air-operated free-piston pump reportedly handles anything that flows and its construction and operation are so simple that it can operate indefinitely without losing efficiency or being shut down. In operation 3 cham-

**TAKES OFF
ITS HAT
TO NOBODY!**



*Carriage, lag and machine bolts.
All sizes. Quick delivery from stock.*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



Equipment News (Continued)

bers fill by gravity or power and are emptied in sequence by air pressure. The air charge is automatically switched from one chamber to another by a timing control that insures an uninterrupted flow. Each chamber, lined with stainless steel, comprises a top plate, a replaceable cylinder sleeve and an inlet-outlet base unit. A free-floating nylon piston is in each cylinder and 2 nylon ball check valves are in each base unit. The piston floats on the charge to eliminate turbulence and minimize air absorption. The piston also seals the compressed air from the base unit. Advantages of the 45x24x53 in pump which handles about 100 gpm include: no vibrations, fast cleaning by removing a few bolts; no safety or relief valves, and long life.

POWER UNIT—The motive power unit seen juicing up an airliner may soon be serving the mining industry, according to U. S. Steel Corp. which supplied much of the steel for the unit's body. The unit, made by Stewart & Stevenson Services, Houston, Tex., is only 48 in high and has power, mobility and flexibility to suit it to all needs for portable power in mining operations, notes U. S. Steel. Able to go anywhere an ordinary vehicle can go, it has power in a range



up to 250 kva. From slower speeds it can be geared up to normal highway speeds and for operation in rough terrain can be equipped with larger wheels.



BELT LOADER—Now in production at Ulmac Equipment Co., Inc., El Paso, Ill., is a high-speed loader that can be hitched in less than a minute to Cater-

pillar motor graders by means of a hydraulic jack mechanism. The unit's 36-in wide high-capacity conveyor is driven through a positive mechanical drive by a 56 hp Wisconsin engine. Discharge height can be varied from 11 ft 9 in to 14 ft 6 in, permitting over-the-cab loading of any 4-yd truck to the largest 10-ton tandems. A new full-floating "spade-action" rotary feeder with self-cleaning feeder blades permits loading of loose material or stripping of in-place material. The machine, with torque-tube and box-beam construction for greater strength and rigidity, is called the U-300 Multi-Purpose Belt Loader.

NEW EXPLOSIVE—An explosive combining low initial cost features of processed ammonium nitrates with the handling ease and controlled shooting of regular explosives has been announced by Austin Powder Co., Cleveland 13. Called "Apcomite," it is said to be more economical to use than on-the-job ammonium nitrate mixes because it produces greater explosive power per foot of loaded blast hole and eliminates most shipping, storage, mixing and materials handling problems. Also, it incorporates specially-processed ammonium nitrate with a primer that eliminates the need for extra priming. There are two types
(Continued on p 157)

Galis
Busmaster®
for Fast, Safe
PERSONNEL
TRANSPORTATION

Self-Propelled with Greatest Economy

Go Modern! Go Galis! The Busmaster portal car has up-to-date features that put your mine ahead with more profits. It's rugged—it will last—and it is tailor-made to best suit your mine. You'll like the safety improvements too.

Length . . . 15 ft. 6 in. Height . . . 32 in to 50 in.
Width . . . 72 in. to 90 in. Capacity . . . 12 to 16 men
Speeds to 20 MPH—(in emergency) . . .
Dual controls—(Operates from either end) . . .
4 wheel Torque converter type drive direct to axles.
Ball Joint wheel suspension system.

2 Separate Brake Systems

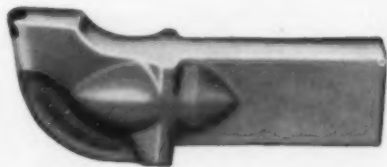
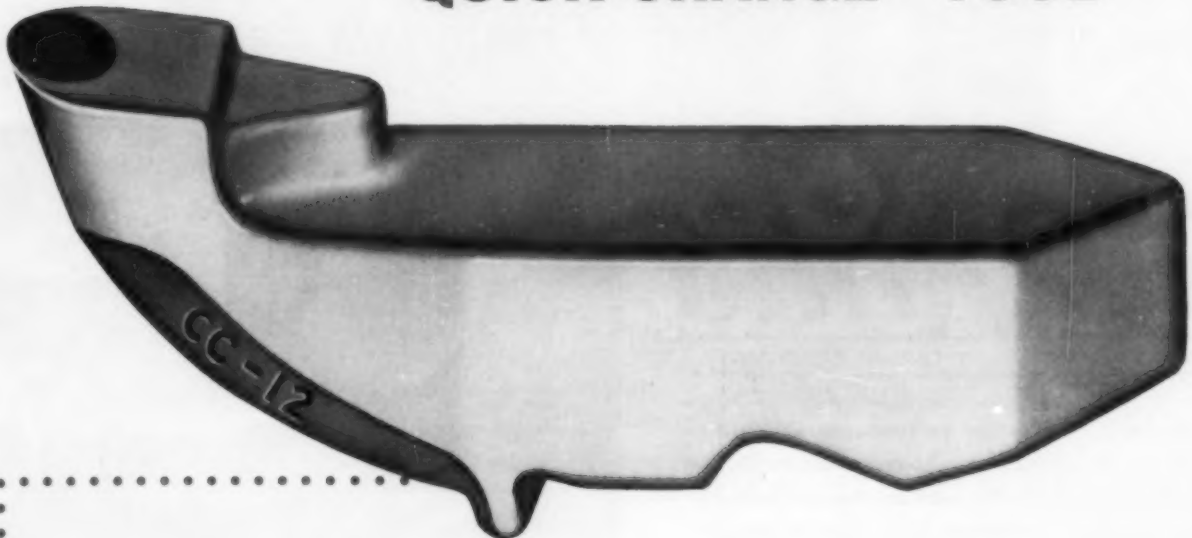
- (a) Hydraulic Dynamic Braking
- (b) 4 unit Hydraulic airplane type disc brakes

Good Visibility for Operator Safety.
May we quote on Motorizing your present equipment!



Phone Morgantown 4668
for repairs of all under-ground mining equipment.

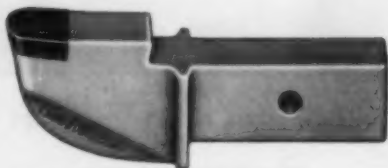
ANNOUNCING A NEW CARBOLOY® "QUICK-CHANGE" TOOL



CC-9—designed to give added shank strength to resist bending.



CC-T— $1\frac{1}{4}$ " gage trimmer bit using the cylindrical tip.



CCH-6—designed for boring-type miners using $\frac{1}{4}$ " roll pin holding method.

Metallurgical Products Department reports on the newest tool in the Carboloy line . . . one that's "built for speed" in changing bits.

The new Carboloy CC-12 mining tool greatly reduces bit changing time. A neoprene cylinder with a $\frac{1}{4}$ " steel pin holds the tool firmly in the block by wedging into the notch at the bottom of the shank. No setscrews needed.

The shank is $1\frac{1}{8}$ " x $\frac{5}{8}$ ", this means 40% larger cross section to give added support against horizontal and vertical cutting forces. The CC-12 is in stock with an enclosed cylinder tip but is also available with other tip designs. The CC-12 has a $1\frac{3}{4}$ " gage and requires a special tool block—as does the CC-9 (left).

So, when you're looking for a mining tool that's designed for today's more powerful machines, ask your Authorized Carboloy Mining Tool Distributor about Carboloy's complete line of quality-designed tools for the mining industry—or write: Metallurgical Products Department of General Electric Company, 11120 E. 8 Mile Road, Detroit 32, Michigan.

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CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL  **ELECTRIC**

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LOWEST COST PER TON

of materials handled

National Mine

TORKARS

SINGLE PRIME MOVER-TORQUE CONVERTER

Dramatic records for performance and low maintenance are being achieved wherever TorKars are used. TorKars are unique in that they are powered by a single, large capacity motor in place of small multi-motors required on conventional shuttle cars.

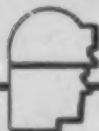
With a torque converter and three-speed forward-and-reverse transmission applying power equally to all four wheels, flexibility of operation is vastly increased, the control system is simplified, service costs are lowered, and high operational standards are maintained.



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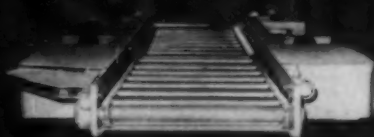
for the
informative new
TorKar Bulletin and for
Specification Sheets
on all models.

**National Mine
Service Company**



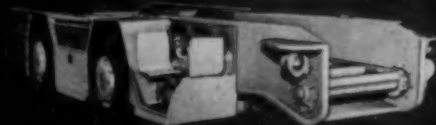
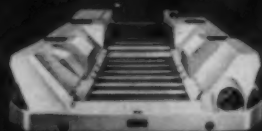
TYPE 26 D.C. or A.C.

Body height 25 1/2", for use in thinnest commercially-workable seams.



TYPE 30 D.C. or A.C.

Heights 30" to 36", capacities from 120 to 167 cubic feet.



TYPE 48 D.C. or A.C.

Heights 40" to 54", capacities 4 to 8 tons (10 tons with side-boards).



The trend is to TorKar

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IN CANADA:

NATIONAL MINE SERVICE (CANADA) LIMITED
Elliot Lake, Ontario



We look inside your commutator at National

...The Specialists in electric coils/repair service

AND HERE'S WHAT WE OFTEN FIND!



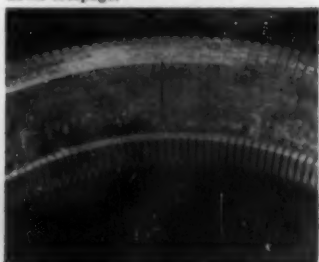
Enlarged view of a dielectric puncture of a mica vee ring at the lower end of the copper bar. This is an example of interior commutator faults which may be present though exterior appears excellent.



Shifted or squirted mica at the apex of the 3° and 30° cone surfaces of a mica vee ring. The black lines on the 3° surface were made by bar-to-bar voltage breakdown creepage.



The bar which projects above those adjacent has been locally overheated under a brush and softened.



A mica segment on the front end of the commutator has started to work out radially and will eventually result in a bar-to-bar short circuit.

When you send D-C machines to National for rewinding or rebuilding, the commutator gets a close inspection and test. But we've found from experience that a commutator that looks excellent on the surface may be in deep trouble inside... with mica cooked, varnish burned, loose copper, or imminent short circuits.

So when we are suspicious of the commutator we remove and open it for a close interior inspection. It's another added assurance that machines rebuilt by National will give you long, dependable service.

For more information, call National's Columbus plant... HUdson 8-1151. Or call the nearest National field engineer.

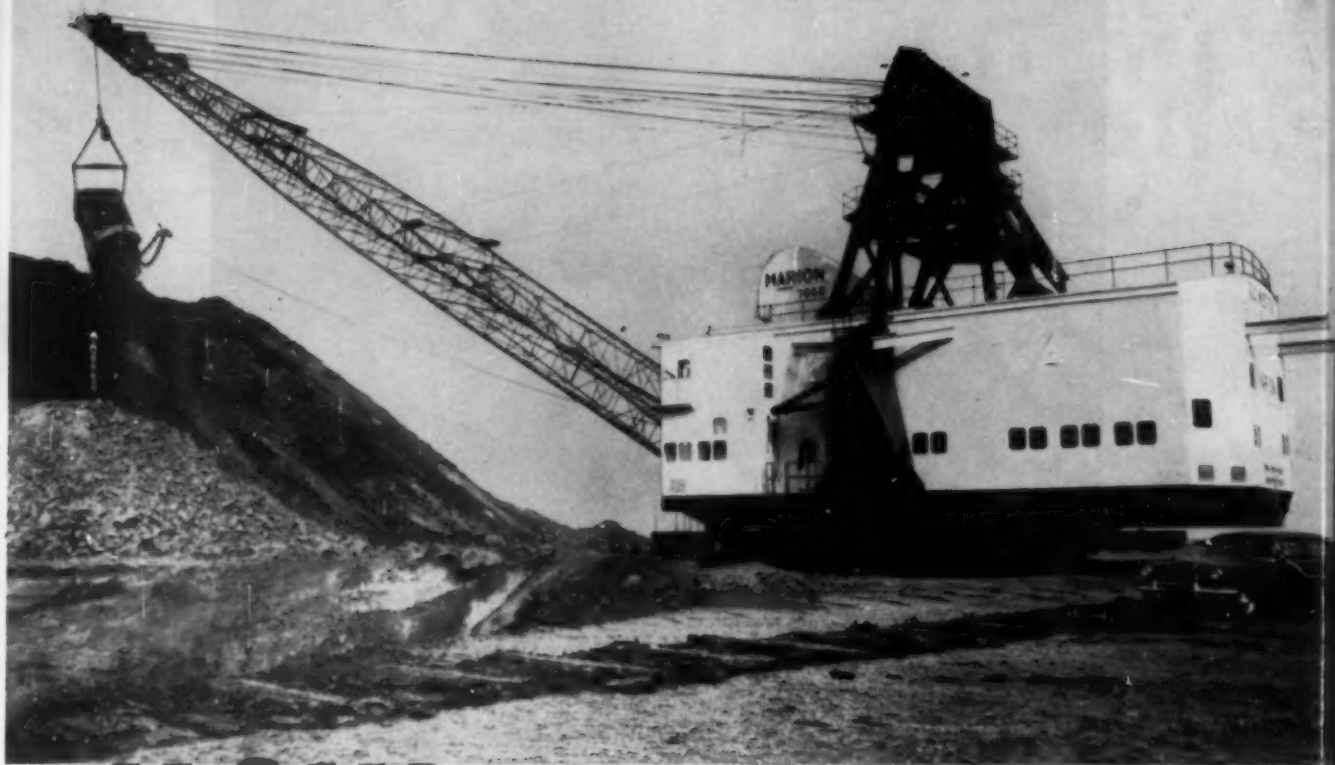
National Electric Coil

DIVISION OF McGRAW-EDISON COMPANY

COLUMBUS 16, OHIO



ELECTRICAL ENGINEERS • MANUFACTURERS OF ELECTRICAL COILS, INSULATION, LIFTING MAGNETS • REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES



HOW TO HANDLE 90 FEET OF OVERBURDEN

The first problem in dealing with 90-foot overburden is to pick it up in meaningful bites. The next problem is to stack it high enough and far enough away to keep it from rolling back into the pit.

The 35 yard bucket and 220 foot boom of the Marion 7800 Walking Dragline provide sound, proved answers for both problems.

Here it is demonstrating its accomplishments in a Canadian mine where it is credited with cutting stripping time by one half to two thirds.

Whatever your stripping problem, there is a Marion machine of the type, size and capacity to assure fast handling at low unit costs.



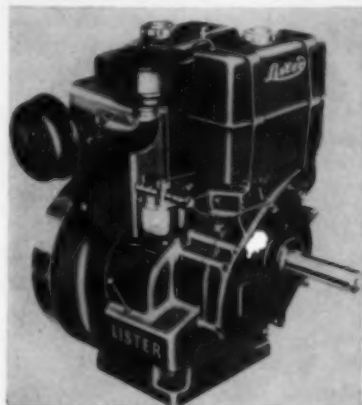
**CONSULT MARION
MINING SPECIALISTS**

for lowest costs
on your property!

MARION POWER SHOVEL COMPANY • Marion, Ohio, U.S.A.
A Division of Universal Marion Corporation

Equipment News (Continued)

offered, both ready to shoot; Apcomite 17 for normal usage; and Apcomite 20A with greater density for wet holes. Both are furnished in 23G tubes in 5 in and larger diameters.



DIESELS — Lister-Blackstone, Inc., Long Island City 1, has air-cooled diesel engines available in ratings from 3½ to 36 hp in 1, 2 and 3 cylinders. All engines are 4-cycle full diesels with the latest improvements in injection systems resulting in low fuel consumption, easy manual starting even in low temperatures and trouble-free operation over long and continuous running periods. With the many accessories available either model is easily adaptable for direct coupling to generators, pumps or compressors. The diesels can also form the power basis for almost any other type of machinery, adds the firm.



PENDENT SWITCH—A new "Safe" Switch, from Joy Mfg. Co., Electrical Products Div., St. Louis 10, is now offered in a 6-station model for pendent applications. It is completely contained



GUNDLACH

Takes the Crushing Problem DOWN TO SIZE!

YOU BENEFIT...

By Control of Top Size — Crushing to size in one operation eliminates recirculating load ... saves time and equipment ... increases overall plant capacity.

By Less Fines — More saleable coal in stoker sizes means more dollars per ton ... if crushing prior to washing, fewer fines means lower washing costs.

By Flexibility ... Can handle larger lumps and frozen coal ... hand wheel adjustment allows you to fill any order down to ¾" top size ... orders heretofore uneconomical to fill are now yours.

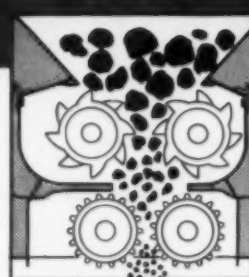
By Dependability ... Ever-increasing list of satisfied users.

By Economical Operation ... Less maintenance... Less H.P. per ton of crushed coal... One Crusher ... Lower initial investment ... No wasted labor in adjusting crusher.

YOUR CUSTOMER BENEFITS...

By Control of Top Size ... Less unburnt coal in ashes ... More BTU output per ton ... Lower ash handling costs ... Greater overall utilization.

By Less Fines ... Simplifies unloading ... increases boiler efficiency.



Uniformity in size consist of GUNDLACH crushed coal eliminates customer complaints, gives customer satisfaction, and increases production.

If you have a crushing problem, you'll find a GUNDLACH representative as near as your telephone.

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P. O. BOX 283 • BELLEVILLE, ILL.

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For high volume and economy, choose the H & P 24" Cyclone. It is an outstanding classifier for all slurries. All the well-known advantages of the H & P Cyclone work for you... the 14° angle... the overflow chamber protecting against abrasion, back-pressure and other adverse effects of directly connected piping systems... the lower working pressure... the higher operating efficiency. It is made of abrasion-resisting steel or can be rubber lined.

Specify the best — the H & P Cyclone.

For more Cyclone facts, write for brochure 1157.

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QCF Load-support MINE CAR WHEELS

Quick-chilling after casting gives QCF Chilled Tread Car Wheels extra resistance to abrasion and wear, gives you real economy through long service life. Gray iron center costs less to mount, reduces vibration and effects of stress concentration. Curved plates support tread at load center: minimize damage to treads.



Cross Section of QCF "Load Support" Mine Car Wheel showing: (1) uniform depth of hardening, (2) extra heavy overhang, (3) support at center of tread.

AMERICAN CAR AND FOUNDRY
DIVISION OF ACF INDUSTRIES, INCORPORATED
750 THIRD AVE., NEW YORK 17, N. Y.

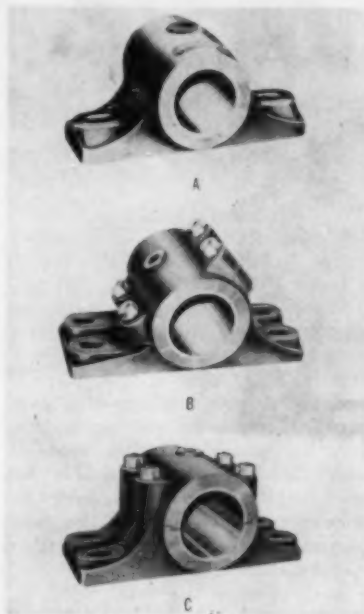


For further information,
just ask your QCF representative.

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Equipment News (Continued)

within a specially-molded 2-piece Hycar enclosure that features waterproof, non-corrosive and lightweight construction. Protected from accidental side pressure by a specially designed ring-shroud, each button is an integral part of the housing. The Hycar housing weighs a fraction of conventional cast-iron units, says Joy, and is about one-third the size. Typical applications include hoist and crane operations, installation over heavy factory machinery and other areas where light, positive-acting weathertight pendant switch stations are needed.



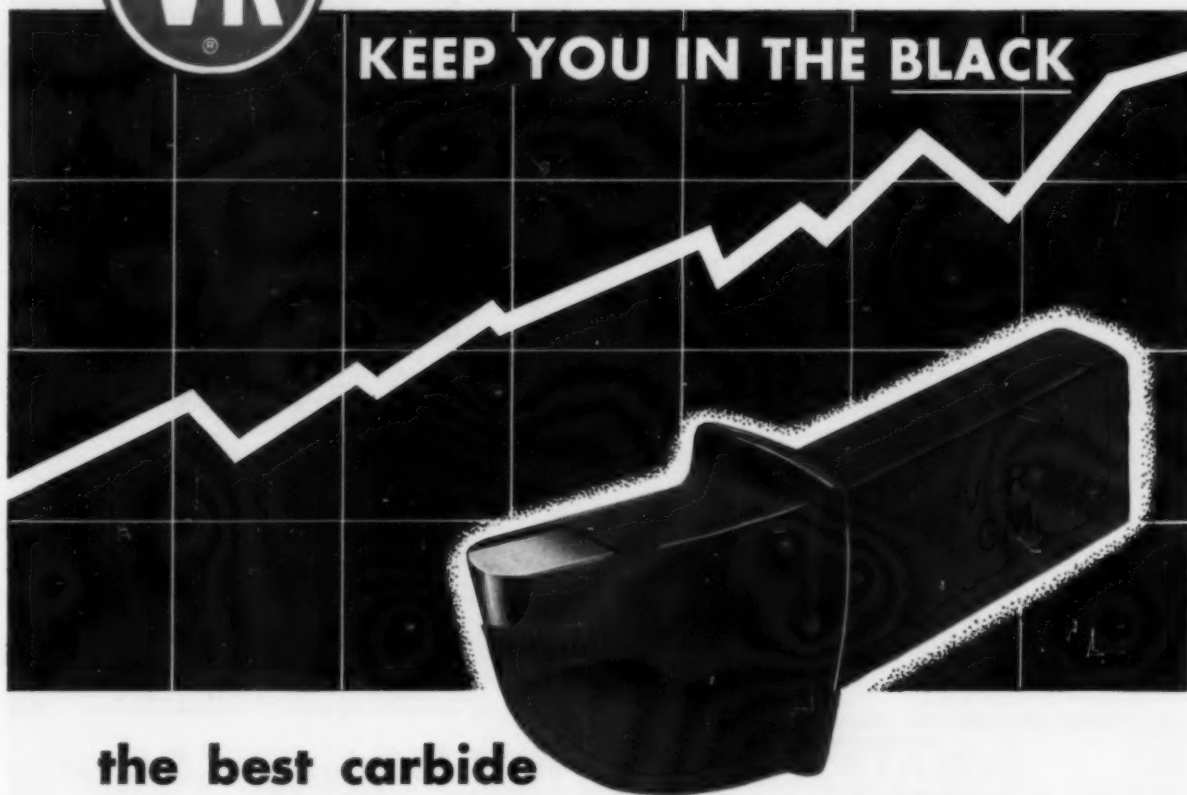
BEARING BLOCKS—Link-Belt Co., Chicago 1, announces the addition of 45 new sizes in 5 new series to its complete line of babbitted and bronze bearing blocks. With the new additions the company now offers off-the-shelf delivery on more than 15 types and over 300 sizes of solid, split, gibbed, angle or flanged pillow blocks for commercial shafting up to 12 in in diameter.

SHEAVES—Simple accurate speed adjustment and non-freezing construction are features of the new "SVS" multiple-groove variable-speed sheave for use with standard V-belts. Made by T. B. Wood's Sons Co., Chambersburg, Pa., the sheave's positive locking action is said to prevent even microscopic motion between components, hence fretting corrosion cannot occur and there is no need for lubrication. Freezing is eliminated also because of the absence of wear and corrosion, notes the manufacturer. Positive-locking collars clamp split flange extensions to a sleeve which is keyed to the shaft on which the sheave is



RED BITS

KEEP YOU IN THE BLACK



the best carbide means more tonnage... lower costs



V-R quality carbide... plus engineering knowledge... plus complete V-R service add up to more tonnage per machine and lower cost per ton.

29 years of carbide research and manufacturing experience... controlling quality from the ore to the finished product... have produced the faster cutting carbides used in V-R Red Bits.

Put these rugged bits to work in your mechanized mining equipment for continuous trouble-free production.

The best mining bits are manufactured at V-R... beginning with the manufacture of the carbide.



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for complete
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PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

M-756

884 Market Street • Waukegan, Illinois

Equipment News (Continued)

mounted. Clamping screws on the collars are tightened to secure the sheave on the motor shaft and to lock all moving sheave parts.



CABLE CONTROL—New heavy-duty Model 110 front-mounted cable control unit designed to meet field demands for a high-capacity fast-acting low-maintenance unit is available for International

TD-20 and TD-15 crawler tractors, according to International Harvester Co., Chicago 1. Patterned after the Model 150, the single-drum Model 110 unit's major castings are of nodular iron, giving high strength coupled with light weight, declares the firm. The TD-20 handles 75 ft of cable with a full drum speed of 514 fpm and a bare drum speed of 336 fpm. On the TD-15 75 ft of cable can also be housed with a full drum speed of 547 fpm and a bare drum speed of 358 fpm. The Model 110 can use up to 1/2-in cable. Two-piece construction brake bands are interchangeable.

DRILLING MACHINE—A diamond-core drilling unit with an air-vacuum mounting base has been developed by the Diamond Core & Saw Div., Portomag, Inc., Ferndale, Mich. The "Vacuum 120-VE" features a quiet reversible vacuum unit that develops 2,000 lb of holding power in 3 vacuum pads at the base of the center column. A flick of the switch positively anchors the machine on smooth as well as irregular surfaces, says the firm. Vertical and horizontal drilling operations are possible. The machine, adds Diamond Core, can be set up by one man in less than a minute. Faster drilling with penetration from 1 to 4 in per min is possible because of



increased pressure that can be applied while the drill is operating. Bit life is reportedly increased because normal vibration is absorbed by the vacuum pads and is not transmitted to the drill itself. The reversible vacuum provides instant release which actually "blows" the machine free.

REGULATOR—A re-design demand regulator for use with demand-type self-contained breathing apparatus has been announced by Mine Safety Appliances Co., Pittsburgh 19. The new regulator features high flow with slight breathing effort, a high-efficiency filter for protection against contaminants, easy field

**VALVES
CYCLONES
PUMPS
PIPING**

*Line
WITH
LINATEX*
(a specially processed rubber)
the most effective way
to combat abrasion

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LINATEX CORP. OF AMERICA
P.O. DRAWER "D", STAFFORD SPRINGS, CONN.

Tight Maintenance Budget?



USE KELLY REPAIR PARTS!

You can save headaches and money too on repairs to underground machinery by using KELLY parts. They last longer! Fully guaranteed and product insured.



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"WRENCHES GO HOME!"

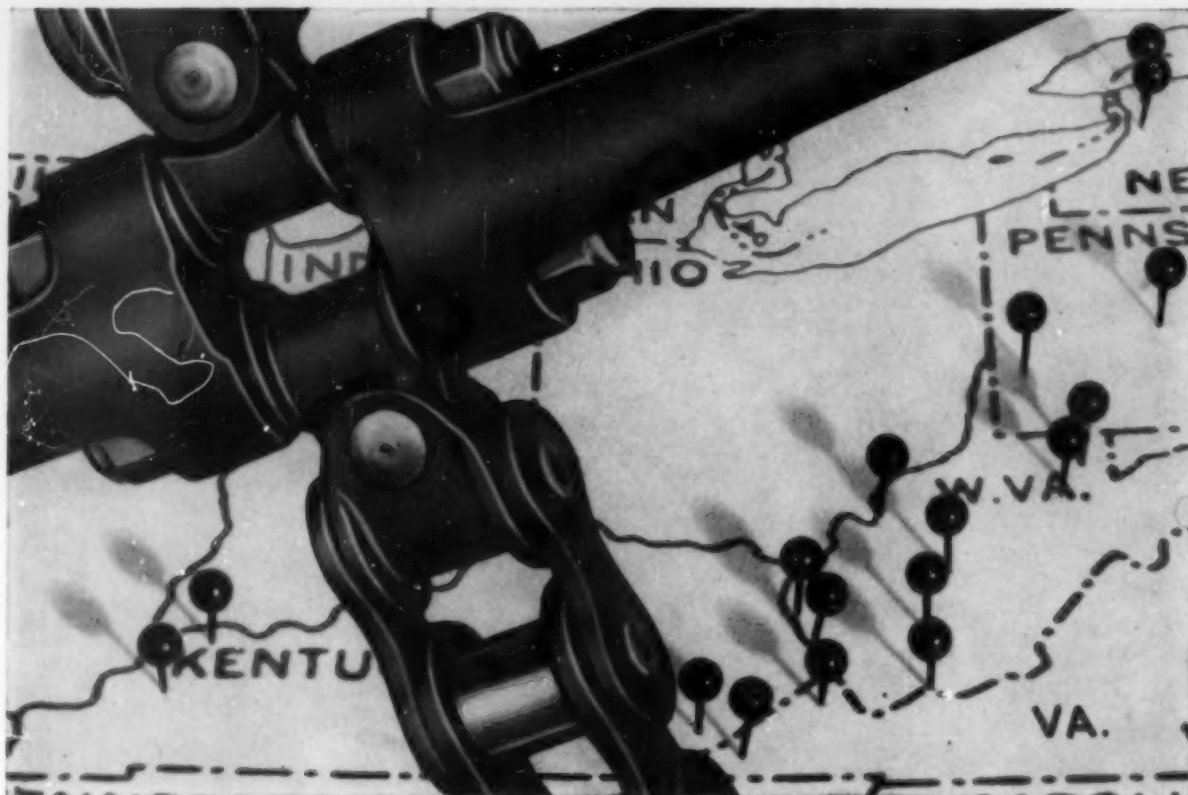
The Amoco mine lubrication engineer is trained to "keep the monkey wrenches out of machinery." He knows all kinds of mine equipment by make and model...knows just which of Amoco's complete line of quality tested lubricants to use for top performance at low-

est cost. Why not use his services as hundreds of deep and strip mine engineers are doing? He'll make a careful survey of your special needs without charge. Contact your nearest Amoco office, or the American Oil Company, 555 Fifth Avenue, New York 17, New York.

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FOR MINE MACHINERY



When you want top performance, you want Amoco



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There's Always A Whitney Mine Chain Distributor Nearby!

Ready with fast, off-the-shelf service!

Whitney Chain distributors are located in key cities throughout all the mining areas. All Whitney distributors carry full stocks of exclusive design Whitney Mine Chain and American Standard power transmission chain. Backed by years of experience, your local Whitney man is a mighty good man to know. He's ready, willing and able to service your particular chain needs . . . quickly and economically.

Here's How Whitney Flight Conveyor Chain Saves You Money

- Detachable flight design prolongs service life. Accurate tapered stud fits solidly as one unit, anchors flight, obsoletes shoulder pins. Quick, easy adjustments or replacement at the face or shop permitted by threaded stud with self-sealing locknuts. Allows you to salvage flights from your old chain for more service . . . more dollar savings!

- Forged steel flights and universal joints, 100% Magna-Fluxed and Mar-Tempered for maximum durability under toughest underground conditions.

- Whitney mine chain offers you the design advantages and simple maintenance of either riveted or cottered type chain.

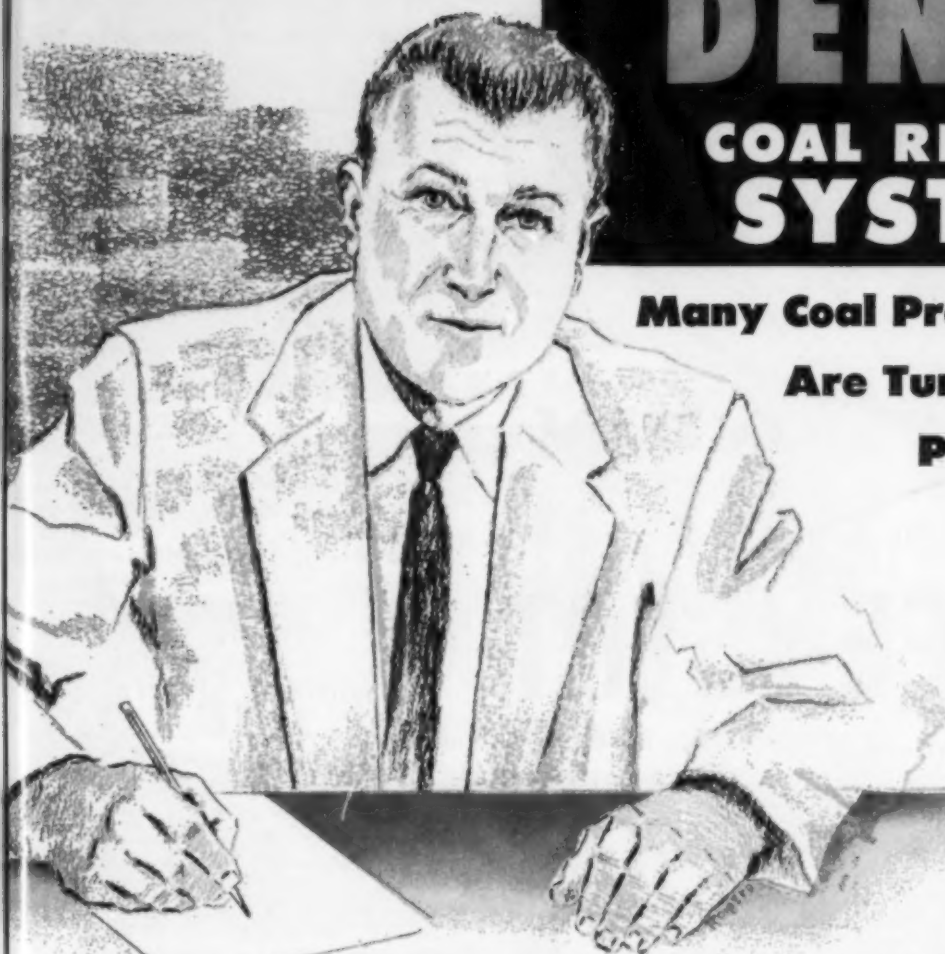
Whitney manufactures the entire product — both chain and flights — to assure complete balanced design, and a fast, complete customer service. Catalogs on request.

Whitney

CHAIN COMPANY

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A Subsidiary of Foote Bros. Gear and Machine Corporation



DENVER

COAL RECOVERY SYSTEMS

**Many Coal Preparation Plants
Are Turning Waste Into
Profits and at the
same time . . .**

- (1) Recover marketable fines from waste water
- (2) Remove solids from washery waste and simplify disposal
- (3) Reclaim water in a closed water system

Compare This Example To Your Own Coal Preparation Plant:

- (A) 1,000 G.P.M. WASHERY WATER IS SENT TO WASTE.
- (B) WASTE WATER CONTAINS 10% SOLIDS AT 20% ASH.
- (C) SOLIDS REPRESENT 26 TONS PER HOUR AND CONTAINS 84% COAL THAT RUNS 5% ASH.

All washery solids (-28 mesh x 0) are sent to a simple Denver Coal Recovery System which, for this capacity, costs about \$86,000 to \$90,000, plus approximately \$64,000 to \$100,000 for installation. (Estimated total approximately \$150,000 to \$200,000.)

Ash in solids, reduced by Denver "Sub-A" Coal Flotation from 20% to 5%, is blended with coarse coal.

Efficiency of system is approximately 92% and produces some 20 tons per hour of 5% ash coal.

Solids in refuse effluent are dewatered to approximately 40% moisture and conveyed to waste.

Clear water overflow is recycled to plant. Efficiency of closed water system requires only approximately 42 g.p.m. make-up water to replace water lost in clean coal and dewatered refuse.

Total coal fines recovered: 20 tons per hour (280 tons per 14 hr. day) @ \$5.00 per ton yields \$7000 per 5 day week or \$350,000.00 per year.

Operating personnel, overhead and maintenance are low.

The increased coal recovery from the fines should pay for this equipment and installation in less than six months and will accomplish these objectives:

- (1) Recover Clean Coal Fines
- (2) Remove solids from washery wastes and simplify disposal
- (3) Reclaim water and close plant water system.

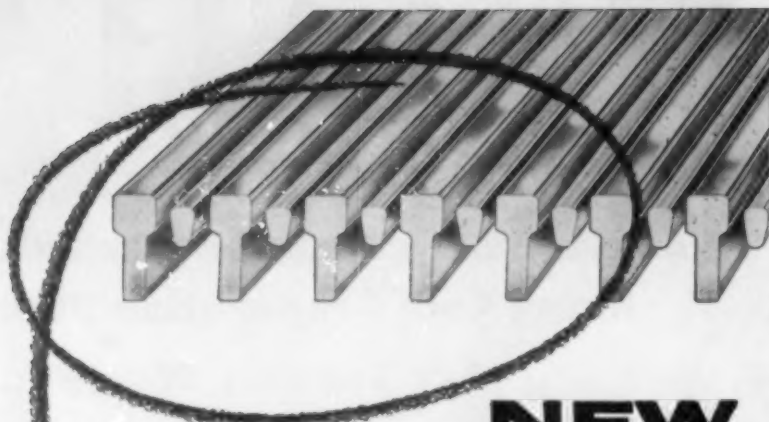
DENVER Equipment Company can supply you a complete, centralized service on Coal Recovery Systems. Estimates and projections based on reliable laboratory test information are available without cost to you. We invite you to use our experience in the fine coal recovery field. Write today!

"The firm that makes its friends happier, healthier and wealthier"



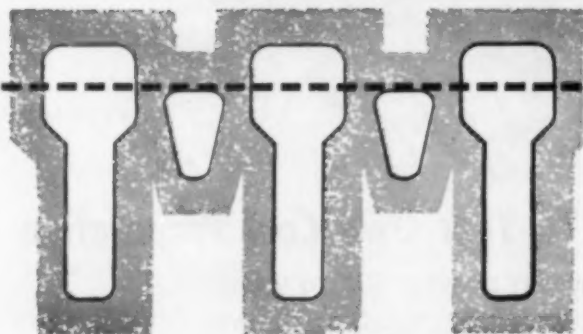
DENVER EQUIPMENT COMPANY

DENVER 17, COLORADO Phone CHerry 4-4466 1400 SEVENTEENTH ST.



NEW * T-WEDGE KLEENSLOT (preparation screen)

screen worn to this point equals new standard type screen



"T" and "WEDGE" wire combine to create the ultimate in...

GUARD BAR DESIGN—high "T" profile wire between every wedge shaped wire performs as guard bar and screen

GUARD BAR ECONOMY—new design effects added screening surface, small screen efficiency with large screen life

with * I. F. A. independent flexing action for non-blinding, non-clogging performance

new T-WEDGE screen is especially adaptable for flumes or vibrator applications—can be easily interchanged with other types of Kleenslot screens without mechanical changes—abrasion resistant stainless steel

FOR ADDITIONAL INFORMATION . . . write

*patent applied for



Equipment News (Continued)



serviceability and sturdy construction, according to MSA. A 2-lever system enables the admission valve to react to minimum breathing effort producing a rapid large-volume flow of air or oxygen to the user. The diaphragm of the regulator serves also as a gasket, providing integrated sealing of the assembly without need for cementing or use of string.


Equipment Shorts

Safety Hats—"SuperGlas" safety hats and caps made by The Fibre-Metal Products Co. have improved safety and weathering characteristics. Featured is a single injection-molded polyethylene suspension unit with a fixed safety factor—at 1½-in clearance from the crown of the hat. Another addition is an adjustable clearance laced to fit the individual user.

Lubricant—Lehigh Chemical Co., Chestertown, Md., is marketing a synthetic instrument oil which offers a significant increase in temperature range and lubricant life over the customary petroleum-based lubricants, according to the firm. Anderol L-281 oil, a medium viscosity diester oil, is compatible with ordinary lubricants and is said to remain fluid up to 100 times longer than ordinary instrument oil, with a temperature range from 75 to 350 F. The result of its long life and greater penetration, declares the firm, is longer protection against rust and abrasion.

Vibrators—From Martin Engineering Co., Neponset, Ill., come electric vibrators mounted in such a way that puts the vibrational orbit close to and parallel with the hopper wall thereby eliminating the need for a reinforcing plate on thinnest hopper materials. This "new concept in electric vibrators" called "Motomagnetic" offers stepless speed control from 2,000 to 10,000 vpm while operating. The units have forced-air cooling and fully enclosed electrics, allowing use on jobs where no other

(Continued on p 168)



BONY COAL?

THICK SEAM?

SLICK TOP?

BRITTLE COAL?

**Whatever the nature of the seam,
there's a Cyanamid Permissible
to do the job economically!**

Cyanamid's group of 12 American Permissibles contains a correct grade for every blasting requirement. Our complete line includes a variety of low, medium and fast rate powders with a wide range of densities.

You get dependable shooting with Cyanamid permissibles. Prompt delivery, too, because our network of plants and magazines closely parallels U.S. coal operations.

Our experienced explosive engineers are always ready to advise you in the correct selection of permissibles. Electric Blasting Caps and other blasting accessories are also available for your operation.

Additional information on Cyanamid permissibles is contained in a brochure available on request.

CYANAMID

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

SALES OFFICES: Denver, Colorado • Maynard, Massachusetts • Kansas City, Missouri • St. Louis, Missouri • Albuquerque, New Mexico
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PLANTS: Grafton, Illinois • Latrobe, Pennsylvania • New Castle, Pennsylvania • Springville, Utah

PRODUCTS: High Explosives • Permissibles • Seismograph Explosives • Blasting Agents • Blasting Caps • Electric Blasting Caps • Blasting Accessories

Drillers get "more hole per hour with a REICHdrill" because . . .

ALL-HYDRAULIC TOP-DRIVE MEANS:

1. Infinitely variable speed of drill rotation from zero rpm to maximum rated speed of model — permits the right rotational speed for every formation.
2. Safety torque release which practically eliminates all chance of drill breakage . . . protects all drive components.
3. Direct-drive to drill stem eliminating power loss . . . no complicated transmission to wear or maintain . . . no rotary table.
4. In and out of the hole faster because no kelly is required.
5. Operator can drill up as well as down should bit become stuck.

when you run a
Reichdrill you've got an
all-hydraulic rig
that features top-drive

And the REICHdrill offers these outstanding advantages: Dependable heavy duty CP Compressors supply plenty of air to suit demand . . . Fast-acting, ram-type hydraulic levelling jacks . . . CP "Air-Blast" Bits give you extra footage in the toughest formations . . . Angle drilling — operator simply sets correct angle and drills.



REICHdrill

Division: Chicago Pneumatic Tool Company

1439 ASH STREET, TERRE HAUTE, INDIANA

REICHdrill Model C-750 Crawler-mounted unit. Hole sizes to 9" diameter. Down pressure to 45,000 lbs.





8 miles of Bethlehem rope in aerial tramways. These continuous tramways, containing approximately 8 miles of husky Bethlehem wire rope, are used in the rock disposal system at the coal preparation plant of Omar Mining Company, at Stirrat, W. Va. Rated at 250 tons per hour, the system crosses a mountain to reach the disposal area. The loaded track cables use four pieces of $1\frac{1}{4}$ in. 1 x 61 extra high-strength tramway strand; the empty track cables have four pieces of $\frac{3}{4}$ in. 1 x 19 extra high-strength tramway strand. The traction ropes are $1\frac{1}{4}$ in. 6 x 19 type U preformed improved plow, lang lay, with independent wire rope core.

In this application, as in so many others, Bethlehem wire rope is relied on to give long service. Top quality in every detail, Bethlehem ropes are available in all popular sizes and constructions.

Bethlehem Steel Company, Bethlehem, Pa. Export Distributor: Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem wire rope

BETHLEHEM STEEL



2,000 Feet of Aeroquip Hose Lines Serve "Big Paul"



"Big Paul" removes 105 tons of overburden per minute at Peabody's River King mine, Freeburg, Illinois.

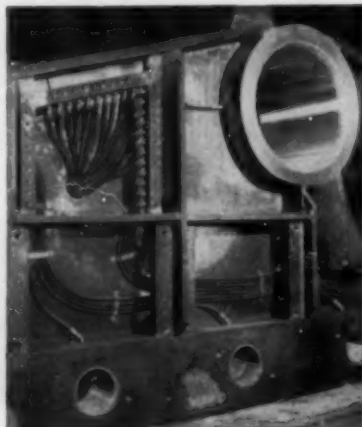
Marion's 70-cu. yd. Giant Shares Honors as World's Biggest Shovel; Works for Peabody Coal Company

Weighing nearly 6 million pounds, "Big Paul" stands 14 stories high, moves on crawlers taller than a man.

Aeroquip Medium Pressure Hose Lines—2,000 feet in all—provide dependable lubrication to these mammoth crawlers.

Aeroquip Hose and Reusable Fittings simplify hose line installation and replacement. Hose lines can be assembled as they are needed, right in the field. Equipment downtime is reduced. Hose line inventory is minimized.

Get full information on the many advantages you get with Aeroquip Flexible Hose Lines. Call your nearest Aeroquip Distributor today.



Aeroquip Medium Pressure Hose Lines supply crawler lubrication for "Big Paul" and other Marion shovels.



Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN
INDUSTRIAL DIVISION, VAN WERT, OHIO • WESTERN DIVISION, BURBANK, CALIFORNIA
AEROQUIP (CANADA) LTD., TORONTO 19, ONTARIO
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

Equipment News (Continued)

rotary electric vibrator could be expected to hold up, says the firm. Quick-clamp mounts can be furnished for jobs where vibrators must be moved from place to place or brought indoors for protection against theft.

Drying—A large-capacity oven designed with a temperature range from 100 to 600 F provides accurate temperature conditions for moisture determination analysis of coal, limestone and other ore, declares Electric Hotpack Co., Inc., Philadelphia 35. A blower capable of circulating up to 550 cfm insures rapid drying and uniform heat treatment of samples regardless of mass. Chamber shelves are extra sturdy to accommodate heavy loads, adds the manufacturer.

Diesel—Cummins Engine Co., Columbus, Ind., has announced a new light-weight naturally-aspirated 160-hp diesel engine for trucking and construction applications. The C-160 is a 6-cylinder engine with a bore and stroke of 4 $\frac{7}{16}$ x5 in and a piston displacement of 464 cu in. It develops 160 hp at 2,500 rpm and weighs 1,555 with standard accessories.

Free Bulletins

Payscraper—Model 295 Payscraper is the subject of a 24-p catalog from International Harvester Co., N. Michigan Ave., Chicago 1. With a 34-yd heaped capacity, the unit gets power from the International DT-817 turbocharged engine developing 375 hp at 2,100 rpm.

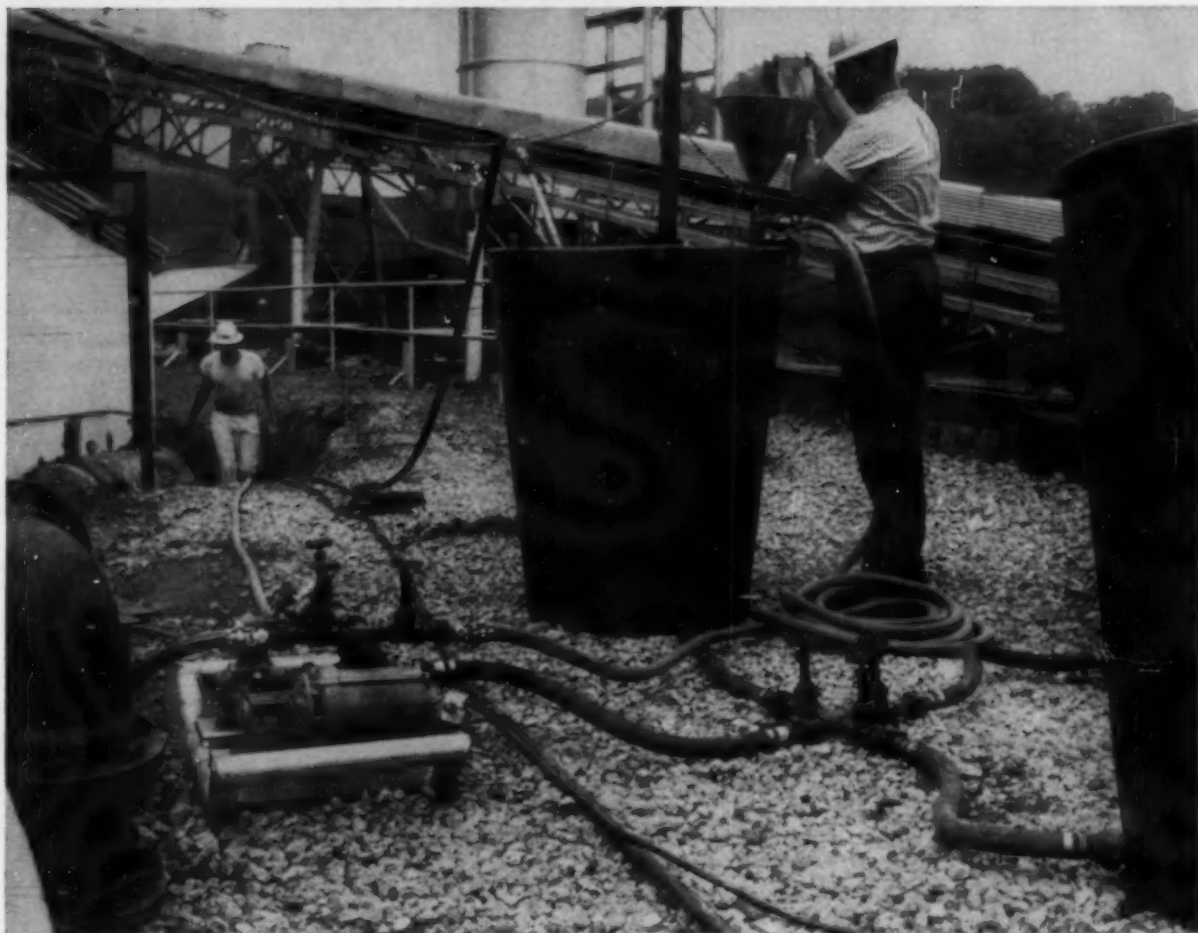
Interrupting—A revised version of the "Interrupting Capacity Chart" is available from Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30. The chart enables users of circuit breakers to select and order the proper breaker for each task.

Tractors—Production and mechanical advantages of the new D9 Series E tractor and features of exclusive new "Power Shift" transmission are given in a 6-p brochure released by Caterpillar Tractor Co., Peoria, Ill.

Pumps—New 8-p Bulletin No. S-111 illustrates and describes the latest features of Apco turbine-type pumps by Aurora Pump Div. of New York Air Brake Co. This line of pumps has capacity ranges up to 150 gpm, pressures to 300 psi and temperatures to 275F.

Flight Conveyor—Bulletin 100 from Columbus McKinnon Chain Corp.'s Mining Equipment Div., Tonawanda, N. Y.,

SEPARAN AP30



This Equipment Takes the Risk Out of Trying Separan AP30 For Flocculating Coal Fines

Using this test equipment, engineers of the Dowell Division of The Dow Chemical Company can demonstrate how Separan AP30® can help coal producers reduce the cost of coal-washing operations.

Separan AP30 was developed by Dow for the flocculation of coal and slimes. An anionic polymer, it offers many advantages over earlier materials.

However, since it is completely different from earlier agents, different application techniques are required. Many operators have been reluctant to go to the expense of setting up experimental mixing and proportioning systems.

Now there is no more risk of excessive experimental costs. Dowell can move in equipment like this, mix Separan AP30, and proportion it into the washing

system. Quickly, Dowell engineers can tell how much Separan AP30 is required and how it can be fed to best advantage.

The operator can tell — in advance — how much he can save by using Separan AP30. He can also experimentally determine the feed points that will give optimum results.

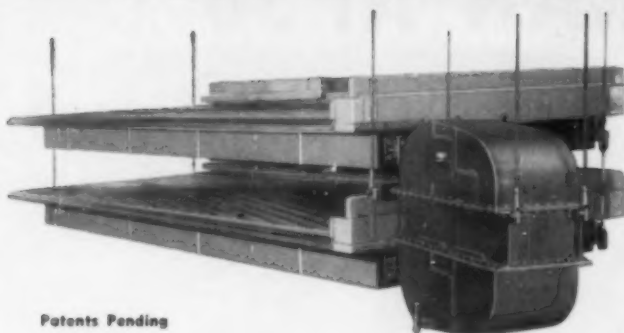
At this stage, risk of loss is negligible. He can then install a simple feed system with confidence of success.

Separan AP30 is available from Dowell stations in the major coal-producing areas of the United States. For more information or consultation, contact the Dowell District office at 1918 Highway 41 North, Evansville 7, Indiana. The telephone number is HARRISON 5-1353. Upon request, a Dowell Engineer will call promptly, without cost or obligation.

Services to the coal industry

DIVISION OF THE DOW CHEMICAL COMPANY

DOWELL



Patents Pending

The Cost of Cleaning Coal Now Substantially Reduced

By employing two identical decks in floating suspension, the CONCENCO® "77" table substantially cuts the cost of preparing coal in the fine sizes.

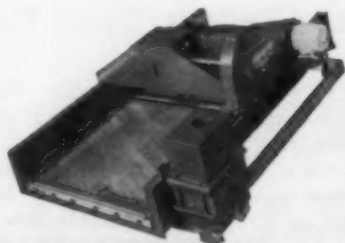
Not only does this efficient table clean twice as much coal in the same unit of floor space, but it effects further economies, less obvious but none the less important in a modern, well-ordered plant. For example, the decks are reciprocated with the same motor used for single deck tables.

Again, the floating suspension so reduces impact to the building that lighter, less expensive housing is required.

It will pay you to investigate the "77" table fully. Send for Bulletin 77.

For Screening Economy

All New Model Looby® screens utilize proven differential vibration that snaps oversize wedging particles loose 1600 times per minute. When dust is a problem, totally enclosed models are most effective. For damp screening, FlexFlex® electric heating of the screen jacket insures full-time open mesh. For efficient wet screening CONCENCO® spray nozzle arrangements are your answer.



THE DEISTER ★
CONCENTRATOR
COMPANY

723 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

CONCENCO
PRODUCTS

★ The ORIGINAL Deister Company • Inc. 1906

Equipment News (Continued)

describes the "Ratio-Feeder," a new method of shuttle car-to-belt feeding. The machine is a chain flight conveyor employing 2 welded link-type chains which converge towards the discharge end. Coal is received from the shuttle car at the car's maximum discharge rate and fed to the belt at a slower controlled uniform rate.

Tractor-Shovel—A specification bulletin explaining features that enable Model 204 Trojan tractor shovel to deliver maximum production for the user combined with economical operation has just been released by the Trojan Div. of The Yale & Towne Mfg. Co., Batavia, N. Y.

Mechanical Drive—The Louis Allis Co., 427 E. Stewart St., Milwaukee 1, has published 6-p Bulletin 3600 on the Allispede mechanical adjustable speed drive which has broad application in material handling. The drive operates on AC and offers speed ranges up to 8:1.

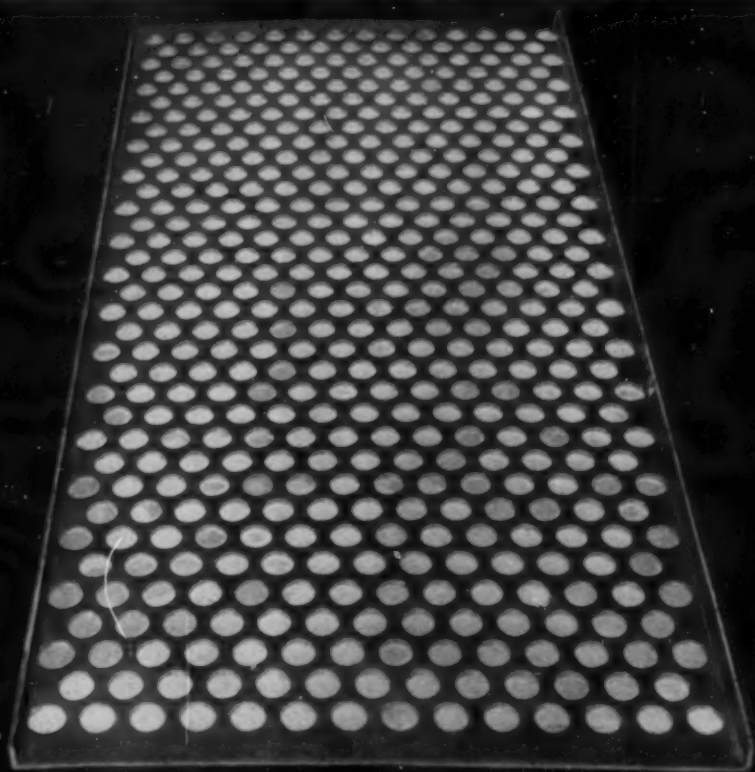
Conveyors—Mechanical vibrating conveyors are discussed in a new 4-p catalog from Syntron Co., 975 Lexington Ave., Homer City, Pa. Complete descriptions, data and specifications for 7 standard mechanical vibrating conveyors are included.

InfraRed—The outstanding ability of electrically-generated infrared heat to provide exceptionally fast and clean car thawing is outlined in a new brochure just released by Fostoria Corp., Fostoria, Ohio. The booklet illustrates typical infrared operations recently installed by a prominent railroad, an electric-gas utility firm and other coal users.

Couplings—An expanded line of Para-flex flexible cushion couplings ranging from fractional to 190 hp per 100 rpm is described in a new 12-p bulletin from Dodge Mfg. Co., Mishawaka, Ind. Photographs, drawings and text explain design features and operating characteristics of Para-flex.

Generators—Characteristics of its high-speed packaged brushless synchronous generators in 40 to 300-kw rating which provide new dependability and minimum maintenance, are offered in Bulletin 51B9192 by Allis-Chalmers Mfg. Co., Milwaukee 1. A combination of brushless excitation system and static voltage regulation control are said to provide the key to the generator's design.

Crane-excavator—Schield Bantam Co., Waverly, Iowa, has announced availability of a 12-p bulletin covering its self-propelled 11-ton Model CR-350 crane-excavator. (Continued on p 172)



DON'T LET
VIBRATING SCREENS
DRAIN AWAY YOUR PROFITS
use
HENDRICK **H** QUALITY STEEL

The quality of the perforated plate you use in vibrating screens can make the difference between profit and loss in mineral preparation. That's why it's a smart idea to use Hendrick H Quality Steel Perforated Plate.

This plate stands up under continuous, heavy-duty operation. It screens coal easier, faster. Full clearance practically eliminates blinding. Deck changes are fast, permitting savings in labor costs. Large open area offers maximum protection.

Hendrick H Quality Steel Perforated Plate

is made from high carbon or stainless steels, carefully developed by Hendrick after many years of experience. It is available either flat, corrugated or stepped, in any desired shape, and with perforations of any size. Write for information on the type of H Quality Perforated Plate that will best fit *your* operation.



Hendrick

MANUFACTURING COMPANY
41 DUNDAFF STREET, CARBONDALE, PA.

PERFORATED METAL • PERFORATED METAL SCREENS • WEDGE-SLOT SCREENS • HENDRICK WEDGE WIRE SCREENS • ARCHITECTURAL GRILLES • MITCO OPEN STEEL FLOORING — SHUR-SITE TREADS • ARMORGRIDS • HYDRO DEHAZERS • DISTILLATION COLUMN INTERNALS.

FLEXCO® FASTENERS!



(PHOTO TAKEN AT PEABODY COAL CO., MINE #10, PAWNEE, ILL.)

Tight production schedules require dependable belt fasteners!



Cutaway of a Flexco application showing the compression plates, teeth and precision-made bolts and nuts.

Daily, the thousands of "working" belt splices throughout the country are proving the superior holding power of FLEXCO joints (no other belt fastener is so widely used). Belt maintenance crews like to work with Flexco fasteners because they are easy to apply—joints last a long time—worn plates can be replaced quickly—ideal for repairing rips and tears.

PROTECT YOUR INVESTMENT IN CONVEYOR BELTS

WITH FLEXCO . . . the quality fastener for all heavy-duty conveyor belt applications: COAL & METALS, SAND & GRAVEL, CRUSHED ROCK, CONSTRUCTION EQUIPMENT, etc.

Available in Steel, Monel, Stainless, Everdur. Also Promal top plates.

ORDER FROM YOUR DISTRIBUTOR, OR WRITE TO US FOR BULLETIN F-112.

"FOR THE SPLICE OF A LIFETIME"

Flexible **STEEL LACING COMPANY**

4638 LEXINGTON STREET

CHICAGO 44, ILLINOIS

FLEXCO "25-PAK"



"25-PAK" contains enough fasteners to join common belt widths.

Equipment News (Continued)

Speed Reducers—Two new booklets with engineering data on shaft-mounted in-line helical and right-angle helical speed reducers are available from Hewitt-Robins Inc., 606 Glenbrook Rd., Stamford, Conn.

New Loader—Sales catalog G-143 covering the new Type 964 low vein loader and catalog G-144 covering Type 870-20 shuttle car have been released by Goodman Mfg. Co., Chicago 9.

Hose—A practical every-day guide for hydraulic hose users has just been issued by Hydraulics, Inc., 40 Lafayette St., Newark 2, N. J. The 16-p catalog outlines low to high pressure hose specifications and has detailed thread and fitting information for both the permanent and re-useable types of couplings.

Underground Mining—The Jeffrey Mfg. Co., Columbus, Ohio, announces a new series of leaflets outlining developments in the firm's line of underground mining machinery. In addition to up to date data on standard units, the series details Jeffrey's most recent equipment developments such as the 76 BM Colmol.

Starters—Six important safety features of Westinghouse Electric Corp.'s new Type L combination safety starters are discussed in a new booklet entitled "Industry's Safest Line of Combination Starters." Box 2099, Pittsburgh 30.

Valves—Ohio Brass Co., Mansfield, Ohio, has a new folder showing its globe angle, check and gate valves for industrial use. Included are charts listing valves by figure numbers, sizes, types of discs, types of pipe ends and pressure ratings.

Treating Waste—A bulletin listing and describing custom designed process water and waste treating equipment is available from Inflico, Inc., Tucson, Ariz. The bulletin outlines applications and features of equipment for chemical feeding, leaching, oxidation, carbonation, purification and clarification.

Magnet Wire—Anaconda Wire & Cable Co., New York 4, announces a new publication to help manufacturing, maintenance and repair firms choose the correct magnet wire for hermetic motors. The 19-p booklet includes a comprehensive table of test data for each of the types of insulation Anaconda recommends for hermetically sealed motor service.

Tractor—A new 14-p catalog covering the HD-16 crawler tractor powered by the Allis-Chalmers 16000 engine is now available from the Construction Machinery Div., Milwaukee, Wis. Featured in the catalog is a fold-out cutaway view of the HD-16 with marginal descriptions.

Among the Manufacturers

Jack H. Connors has been named vice president and general manager of KW-Dart Truck Co., subsidiary of Pacific Car & Foundry Co.



Connors

Mr. Connors comes to KW-Dart, manufacturer of heavy-duty off-highway trucks and other vehicles, from another subsidiary of Pacific Car, Texas Kenworth Corp., where he was vice president and general manager of its Texas Div. He joined Texas Kenworth from the World Bank organization where he had been a loan consultant. Replacing Mr. Connors as vice president and general manager of Texas Kenworth Corp. is R. J. Hutchinson, formerly an administrative assistant.

Appointment of David D. Hunsaker as manager, Sales Dept., of The Frank G. Hough Co., has been announced by H. R. Brown, sales manager, "Payloader" Div.



Hunsaker

In this newly-created position, Mr. Hunsaker will be responsible for sales engineering, training aids, product knowledge and merchandising programs. Mr. Hunsaker was formerly a district manager and has been associated with the Hough Co. for almost 14 yr.

Joy Mfg. Co. has appointed Industrial Electric of Washington, Inc., Washington, Pa., as authorized rebuilder of Joy machines and sub-assemblies in the Pittsburgh coal district.

Rebuilding will be done to Joy specifications with exclusive use of Joy replacement parts.

The Okonite Co. has announced that it will assume responsibility for the sales of Kennecott Wire & Cable Div.'s products.

In the past most of these copper wire mill products were marketed through the facilities of Chase Brass & Copper Co., Waterbury, Conn.

At Ohio Brass Co. J. H. Sanford, manager of the O-B Mining Div. since 1940, has been named to succeed J. R. Palmer, who retires, as manager of the Transportation Dept.

M. F. Cowing is now assistant manager of the department and F. F. Smith is

in charge of a new order service section. Also promoted is Robert A. LeFevre who becomes manager of marketing services. Succeeding him as general advertising manager is Joseph B. Polhemus Jr.

Wright-Thomas Equipment Co., Charleston, W. Va., has been named crane-excavator distributor by Bucyrus-Erie Co.

The new distributor will handle territory including: the entire state of West

Virginia except the counties of Hancock, Brooke, Ohio and Marshal.

George C. Jennins was selected as wire rope sales manager of the Colorado Fuel & Iron Corp.

Clyde V. Johnson moves up as manager of the Central Sales Div. of Denver Equipment Co.

Joy Mfg. Co. has acquired the assets and business of Western Precipitation

CHECK THE NEW

Connellsville MINICAGE

(TRADE MARK)



**The Service Elevator for
Preparation Plants and
Underground Installations**

- REDUCE DOWN TIME
- ELIMINATE FATIGUE
- SPEED UP MAINTENANCE

This all-steel Connellsville MINICAGE with 1000 lbs. and up capacity travels the outside wall of an existing preparation plant . . . or may be designed for inside a future-planned facility. Operates automatically at speeds of 50 to 75 feet a minute.

The sturdy fabricated steel structure with pantograph-style gate is mounted in place and safely attached to wall. Drive assembly at top of structure is coordinated with the MINICAGE and level doors by a control system. Wall openings at levels have hinged safety doors.

The entire Connellsville MINICAGE installation complies with federal and state mining laws.

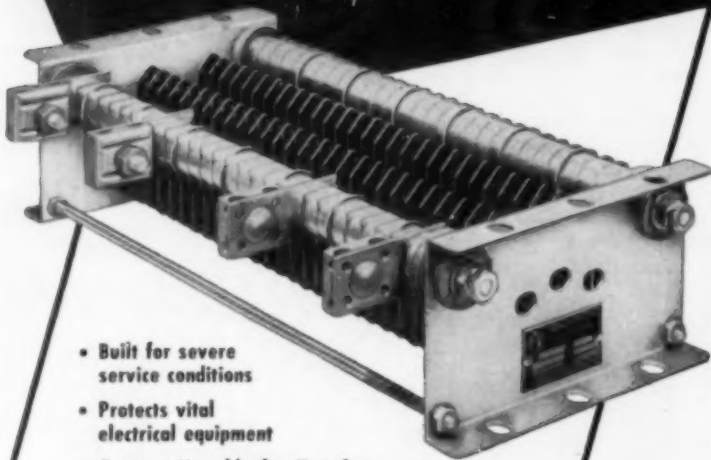
For additional information and details on the Connellsville MINICAGE and other elevators, cages, hoists and conversion units, write for Bulletin No. 200.



Connellsville
MANUFACTURING
CONNELLSVILLE, PENNSYLVANIA



Steel Grid Resistor plays an essential part in the production of COAL...



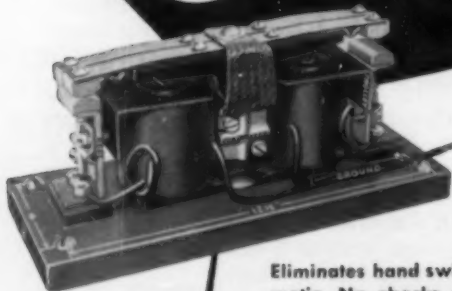
- Built for severe service conditions
- Protects vital electrical equipment
- Constant "trouble free" performance

These rugged nonbreakable units have proved their merit in all kinds of service for many years. Made of steel and mica, plus P-G unique and exclusive grid design, P-G Resistors are capable of protecting your most vital electrical equipment, even where service requirements are severe.

*Designed to fit
your present
resistor space*



AUTOMATIC Transfer Switch



Single or double
trolley and reel

Eliminates hand switches—entirely automatic. No shocks or burns to operator while changing from trolley to reel. Simple, safe, efficient, easy to install, can be mounted anywhere. For 250 to 600-volt service. Complete with cover.



THE **POST-GLOVER** ELECTRIC COMPANY

OFFICE and FACTORY—Kenton Lands Road, Erlanger, Kentucky

MAILING ADDRESS—Box 709, Covington, Kentucky

Corp. of Los Angeles in a move intended to expand Joy's position in air handling and dust collection equipment.

Western Precipitation, a leading supplier of electrical precipitator, filter, wet scrubber and mechanical types of dust collecting equipment, will be operated under its own name as a division of Joy.

Airdox Cardox Products Co. has been appointed national sales-service representative for The Long Co.'s new line of coal drilling and roof bolting machinery.

Operations will include complete information and technical assistance from all Airdox Cardox field engineers working directly with mine operators in coal mining areas.

Fairmont Machinery Co. has acquired Lecco Machinery & Engineering Co. of Bluefield, W. Va. and will operate the producer of horizontal and inclined vibrating screens and conveyors as a wholly-owned subsidiary.

Charles W. Beauchamp has been appointed marketing manager—sales for Link-Belt Co.'s Ewart plant in Indianapolis, Ind., and Kendrick M. Hickman has been named sales manager. Retiring as sales manager was F. H. Spencer.

Herbert H. Murray has been appointed district manager of distributor sales in the Pittsburgh territory for Parker-Hannifin Corp.

Mr. Murray's district is comprised of western Pennsylvania, West Virginia and the eastern tier of Ohio counties.

W. T. Delcour is the new manager of Goodyear Tire & Rubber Co.'s industrial products district office at Denver, Colo., and J. A. Bailey Jr. has been named manager of hydraulic hose sales.

Kirk Usher has been appointed manager of tubular product sales for Aluminum Co. of America.

Dale W. Turnbull, until recently Caterpillar Tractor Co. district representative in Oklahoma and Kansas, has been named supervisor of wheel tractors and motor graders, Products Div.

Charles J. Lloyd has been named sales engineer for mining and aggregate screens by Cross Perforated Metals of National-Standard Co.

Based in Fairmont, W. Va., he will cover Virginia, West Virginia, Tennessee, Kentucky, southern Indiana and southern Illinois.

Otto R. Brown has been named western regional manager of the explosives and mining chemicals division of American Cyanamid Co.

Mr. Brown has been with Cyanamid since 1935.

PROFESSIONAL SERVICES

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Land Examinations • Testing • Appraisals

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49 Years' Service to the
Coal and Salt Industries and Consultants
Construction Engineers and Managers
Authoritative Reports and Appraisals
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120 Wall Street, New York City

HERBERT S. LITTLEWOOD

Consulting Electrical Engineer

Evergreen Hills Irwin, R.D. #3, Penna.

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Exploration of Coal Properties. Guarantee satisfactory
coal cores. Inside Mine Drilling. Pregrouting. Mine
Shafts. Large diameter holes.
Huntington 17, W. Va.

C. Ed BERRY

Coal Preparation Engineer

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OIL TREATING—FREEZE PROTECTION
BULK DENSITY & HANDLING
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Mining Engineers

COAL OPERATION CONSULTANTS
VALUATIONS

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Consulting Engineers

Mine Operation—Preparation
Coal Property Valuation
Industrial Engineering
Union Bldg. Charleston, W. Va.

PAUL WEIR COMPANY

Established 1920

Mining Engineers & Geologists

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Mining Consultant and Engineer

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Drill Contractors Since 1902

Specialists in exploratory—grout hole and pressure
groutings. Rigs located in over 50 strategic areas for
prompt service. Free estimates.
104 Cedar St. Punksuawney, Penna.

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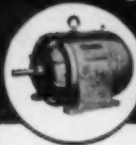
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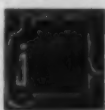
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- 2-Goodman 212 Cutting Machines, 19" high.
- 4-Goodman 312 Cutting Machines, 17" high.
- 2-Goodman 412 Cutting Machines, 19" high.
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- 4-Goodman 512's, rebuilt, or at removed from service.
- 3-Goodman 112's, 220/440 V. AC.
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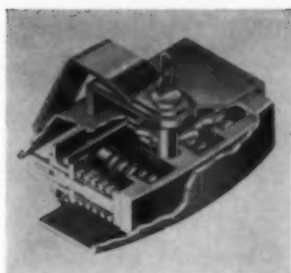
EQUIPMENT

(Used or Surplus New)

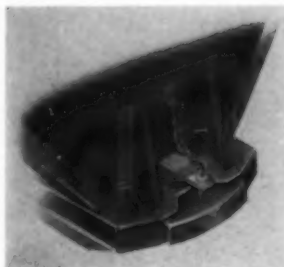
For Sale 175-179

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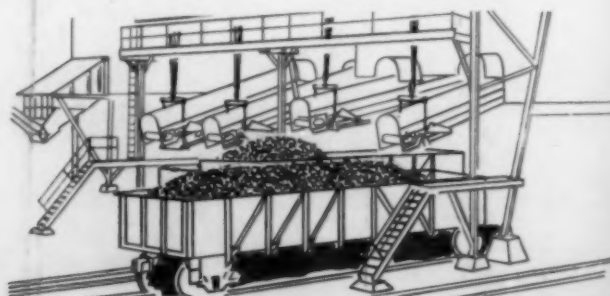
REFUSE DISPOSAL — Link-Belt conveyor systems handle such rejects as table refuse, crushed mine rock and dryer furnace ash. Link-Belt refuse dumpers also aid in disposal.

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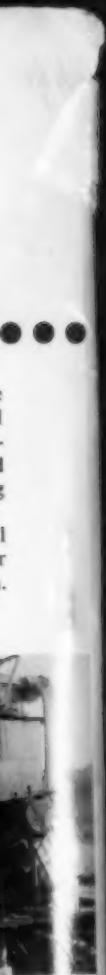
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